Electrical World and Engineer

THE CONSOLIDATION OF "THE ELECTRICAL WORLD" AND "ELECTRICAL ENGINEER."

VOL. XXXVI. NEW YORK, SATURDAY, AUGUST 11, 1900. No. 6.

PUBLISHED EVERY SATURDAY BY

ELECTRICAL WORLD AND ENGINEER

(INCORPORATED.)

120 LIBERTY STREET, NEW YORK.

TELEPHONE CALL: 4044 CORTLANDT. CABLE ADDRESS: ELECTRICAL, NEW YORK.

J. M. WAKEMAN, - - - - - - - - President and General Manager.

CHICAGO OFFICE, - - - - - - - - - - - - 936 Monadnock Block.
PHILADELPHIA OFFICE, - - - - - - - - - - 929 Chestnut Street.

EUROPEAN OFFICE, - - - - - - - - - - A. C. Shaw, Manager.
Hastings House, Norfolk St., Strand, London, England.
PARIS, - - - - - - - - - Electricity Building, Paris Exposition.

T. C. MARTIN AND W. D. WEAVER, - - - - - - - - - - - Editors.
T. R. TALTAVALL, - - - - - - - - - - - - - Associate Editor.
CARL HERING, - - - - - - - - - - - - - - Special Contributor.

NOTICE TO READERS
WHO ARE NOT SUBSCRIBERS.

The ELECTRICAL WORLD AND ENGINEER is not returnable from the newsdealer. If you desire to purchase the paper from a dealer it will be to your advantage to notify him that you will want it, in order to insure his having a copy for you. If you wish to receive the paper regularly, please send in your subscription so that we can mail it to you direct.

Single copies are 10 cents each. The 52 copies for the entire year cost $3.00 in advance. Please send remittance with your subscription order.

ELECTRICAL WORLD AND ENGINEER.

NOTICE TO ADVERTISERS.

Change in advertisements intended for a particular issue should reach the office of the ELECTRICAL WORLD AND ENGINEER on or before MONDAY morning of the week of issue. New advertisements can be received up to 10 A. M. of Tuesday of the week of issue.

The first issue of each month is an export issue, having an extraordinarily large foreign circulation in addition to the regular domestic and foreign circulation of this paper.

TERMS OF SUBSCRIPTION.

United States, Canada or Mexico, - - - - - - - - - - - per year, $3.00
Foreign Countries, within the Postal Union, - - - - - - - - - - - 6.00
Single Copies, - .10

In requesting your address changed give OLD as well as new address.

Copyright, 1900, by the Electrical World and Engineer, Incorporated.

Entered as second-class mail matter at the New York Post Office.

NEW YORK, SATURDAY, AUGUST 11, 1900.

CONTENTS.

	PAGE
Editorial	199
Electric Traction on the New York Elevated	202
New York Electric Automobile Stages	202
The Trenton Automobile Exposition	202
A Large Electric Cautery	202
The Chicago Stock Quotation Fight	202
The Paris Metropolitan Underground	203
Electrolytic Interrupter, by Benj. F. Bailey	207
Test of Street Car Brakes	210
The Western Electric Company's Exhibits, Paris Exposition	211
The Exhibits of the Bullock Electric Mfg. Co. and the Lorain Steel Co	212
Exposition Notes	213
Development of the Radiophone	214
Current News and Notes	214
LETTERS TO THE EDITORS:	
Recording Telephones, by E. Berliner	216
Shunting Thomson Recording Wattmeters, by Frank P. Cox	216
Digest of Electrical Literature, Compiled by Dr. E. F. Roeber	217
New Books	222
The "Column" Indicating and Recording Instruments	222
The Fisher Cable Testing Set	225
Enlarging the Gould Pump Plant	225
Improvement in Tool Steel	225
The Naval Electric Company	226
Garton Trailer Connector	226
Compound Duplex Pressure Pump	226
DEPARTMENTS:	
Financial Intelligence	227
Commercial Intelligence	227
Special Correspondence	229
General News	229
Legal	232
Obituary	232
Personal	232
Trade Notes	233
Illustrated Record of Electrical Patents	233

TELEGRAPH EARNINGS.

Throughout all the changes of the stock market Western Union preserves a strikingly even tenor in quotations. If anything, it has gone down rather than up during all the recent period of prosperity. No sufficient reason for this has been given, but it has lately been pointed out that telegraph profits do not increase with gains in the volume of business. For example, in the year ended June 30, 1867, the company sent 5,879,282 messages. Its receipts were $6,568,925, and the profits $2,624,919. For the year ended June 30, 1899, the company sent 61,398,157 messages. Its receipts were $23,954,312, and its profits $5,868,732. A tenfold increase in the number of messages brought less than a fourfold increase in receipts and only a little more than doubled the profits. In other words, the ratio of profit per message has maintained a steady decline, offsetting the greater volume of business.

SUBMARINE CABLE ENTERPRISE IN THE PACIFIC.

The recent disturbances in China have again called attention to the inadequate facilities for submarine cable communication of certain portions of the Chinese coast with the Atlantic nations in general, and between the Far East and the United States in particular. It seems that the British Empire has now determined to establish cable communication between the Australian colonies and Canada in order to assist Australasia. In the House of Commons Sir Edward Sassoon asked the Secretary of State for the Colonies, a few days ago, whether the Pacific Board had now definitely decided to begin the laying of their cable. Mr. Chamberlain replied that the various governments had accepted the recommendations of the Pacific Cable Committee, and that tenders for the establishment of the cable service, etc., would be called for immediately.

If it pays Greater Britain to span the Pacific over a very awkward geographical route when she already controls one line of communication to China and Australia from London, how well it should pay the United States to establish communication between California and the Philippines over a comparatively simple geographical route via Hawaii and Guam, taking either Midway Islands or Wake Island en route; considering that the present line of communication is not only circuitous but also under foreign control, as we pointed out last week.

With every succeeding month and year of American occupation of the Philippine Islands, the trade and business with that large territory must increase, and already it would seem that the annual cost of cabling from the United States to the Philippines is over half a million dollars at the rate of about $2.30 per word. Moreover, the distance from the United States to China via an American Pacific cable would be about seven thousand sailor's miles; whereas, via Europe, the distance is about twice as great. Consequently a trans-Pacific cable would be a short cut to China for the Chinese traffic.

Every violent disturbance of the existing order of things in semi-civilized countries produces a temporary arrest and diminution of trade, which is always followed by a revival that more than compensates for the setback; since new ties and closer connections are established under more civilized methods. After the troubles in South Africa have passed away, a more rapid progress in trade with that country may surely be expected. Similarly, after the present tumult in China has subsided, there can only be as a result a more rapid civilizing, and opening up of occidental trade, with a great need for cables.

Underground Electric Roads.

Having just closed a series of articles on the new London electric underground railway, we now give in this issue a very complete account of the new Paris Metropolitan electric underground. In both instances, the results obtained from the system appear to be very satisfactory, as might have been expected, although the methods adopted are quite dissimilar. In London, the tunnel lies deep below the surface, while in Paris there appears to be but one station where elevators are necessary for the passengers, namely, at the Place de l'Etoile, where the Arc de Triomphe crowns the long slope that rises from the Place de la Concorde. As a matter of fact, while the London road is down 60 to 80 feet, in Paris the line runs quite near the surface and has the street bed for a roof. Both roads are, however, remarkably cool, and our correspondent in Paris informs us that recently during the extremely hot weather, men were seen to turn up their collars on descending from the street level to a station. Conversely, both railways should be snugly warm in winter.

While in London there is a long train with a heavy locomotive, altogether in the old steam style, in Paris is seen a motor car with a couple of trailers, the motor car itself carrying passengers, thus coming nearer to ordinary trolley or conduit car practice on the surface railways. The London locomotive can, of course, drop a car or two, and the Paris motor car can hitch on another trailer in an emergency. It remains to be seen how the two systems will work out, but it is fair to infer that the Paris plan will prove more flexible and economical, unless the traffic in London is going to be so heavy all day long that the seven cars of the regular train will always be well filled. On the other hand, the Paris service has a poor schedule, approximating to that of the wretched service on the surface lines. Americans in Paris this year have had to wait anywhere from twenty to forty-five minutes for a street car or omnibus, and on this new line the headway is ten minutes. In New York that would be a deadly delay, and such a line would go into bankruptcy within the year. Probably the Paris line will greatly increase its rolling stock and cut down the headway, but even then the waits at the stations—nearly a minute—will be unduly long—according to American ideas, and will offset many of the advantages of electricity.

As in London so in Paris, much of the apparatus is of American origin or prototype, and in both cities three-phase transmission has been adopted, with continuous current on the track, as so often exemplified in this country. It now remains to be seen whether some lessons for American sub-surface roads can be learned from Europe, or whether when the time comes to equip such lines here some further advances in the art will be scored.

Municipal Plants.

The fourteenth annual report of the U. S. Commissioner of Labor, just issued, is a bulky volume dealing with water, gas and electric light plants under the conditions of public and private ownership. This is a document of more than ordinary value and owes its origin, as will perhaps be remembered by many of our readers, to the action in 1896 of the National Association of Officials of Bureaus of Labor Statistics, when resolutions favoring such an inquiry were adopted. It may be said, incidentally, that the resolutions were pushed by those who favored municipal ownership and who thought that the Labor Bureau might be used for such a campaign. Just where the Labor Bureau came in is not very clear, but still, if money had to be spent on the investigation by some authority, that was doubtless as good as any other. The work has apparently been done with considerable care.

The statistical territory covered by the report, which fills an octavo volume of nearly 1000 pages, is quite remarkable. It would appear that the plants investigated represent over 56 per cent of the value of product. Out of the water works, 375 or 24.37 per cent, private, and 659 or 36.88 per cent, public, reported. Of the gas works, 356 or 37.43 per cent, private, and 11 or 78.57 per cent, public, reported. Of the electric light plants, 632 or 24.57 per cent, private, and 320 or 69.57 per cent, public, reported. These figures bring out, by the way, the curious anomaly that while in this country the municipal water works are four times as numerous as the municipal electric light plants, they are 127 times as numerous as the municipal gas works, the numbers being, respectively, 1787 water, 460 electric, 14 gas. It is difficult to realize that the gas field has been so wonderfully free from the municipal plant agitation, or any results from it. The same freedom is true of the street railway field, which bids fair to remain in the hands of the private enterprise which has already done such marvels of progress with it.

Now as to the results of the test or investigation, they remain negative, as we ventured to predict they would at the time the work was begun. The authoritative preface to the report says: "The completeness of this report will not prevent disappointment, and this will be felt in several directions. There will be disappointment because the facts classified will not and cannot settle conclusively the merits of the two systems of management—private and municipal." In other words, the elaborate indictment that was to have been proved against private ownership of electric lighting plants, for example, has fallen to the ground. As before, certain data can always be produced or deduced favorable to a municipal plant, while, on the other hand, as the report says, "the question of cost is very largely one of management, the varied conditions of supply being taken into consideration."

The electrical section of the report has a general analysis of some 20 pages to which we may have occasion to return for a discussion of the summaries. These are based on over 400 pages of tables, the study of which would be no mean task. They would seem to cover the ground, but even a casual glance shows that they leave points open that would vitiate a whole train of conclusions. As pertinent, perhaps, to one of the ideas had in mind by some of those who promoted this costly inquiry, we note that so far as salaries are concerned the average cost in municipal plants is smaller in every group represented, in some cases being less than one-half the average cost in private plants; while, as regards wages, in seven of the groups the average cost in the municipal plants exceeds that in the private plants; while in eight of the groups this cost in the private plants is greater than those municipally owned and controlled. Now this is rather contradictory, but exemplifies the ordinary yield of all such investigations. So far as labor is concerned, it would appear to be best off under the private regimé, and the higher cost of management might be due to the fact that a municipal plant often is a part of other plants belonging to a city, so that an official's salary can be charged out thinly over a lot of departments. But private ownership since 1896 has also approximated such a condition in the frequent consolidations of local enterprises under one central management whose expenses are thus distributed.

Wehnelt Disruptive Discharges.

The handsome photographic reproductions of discharges appearing in Figs. 6, 7 and 8 of Mr. Bailey's article in this issue, indicate the intricate nature of the phenomena involved. In Fig. 6 we have a bundle of filamentary discharges nearly horizontal. Each of these filaments is a separate discharge, and according to the description, all of them occurred within the interval of about one second of time. In Fig. 7 the approaching of the electrodes has apparently had the effect of condensing the numerous filaments into a narrow band with a much greater heating effect upon the air, as evidenced by the upward convective

movement of the band in the centre of its length. Much experimental and analytical work might doubtless be carried on to determine the nature and magnitude of the forces acting on these discharge paths. At the present time we can only guess at the causes of a very beautiful series of phenomena, which are brought within the reach of all who have access to direct-current circuits, through the use of an induction coil and the Wehnelt interrupter.

PRACTICAL RESONANCE.

The subject of resonance has been under discussion in a somewhat desultory way for a number of years, but only since the growth of long-distance power transmission have the phenomena involved risen to such a degree of practical importance as to force themselves on the attention of the harassed engineer. For a considerable time those interested have been divided into two classes: First, those who never having encountered or recognized the phenomena of resonance in their practical working, have been of the opinion that the whole affair is principally of academic interest—a good thing for theorists to juggle with and mathematicians to disport themselves about. The second class has been composed of those who have realized the evil effects of getting an electric system attuned to its frequency or a harmonic thereof, and who have come more or less violently in contact with the results. It is high time for the practical and theoretical groups to come together in the endeavor to control the output of this somewhat formidable agency.

In all seriousness, within the past year or two attention has been forcibly directed to the importance of the phenomena of resonance by very violent occasional manifestations, seldom occurring often upon any one line, but appearing casually upon a large number of systems. Around every high-tension plant appears, at intervals, violent arcing and sparking, sometimes of a highly destructive character, which cannot be accounted for by any electromotive force properly belonging to the system. In a few cases which have come under our personal observation, the results have been of a serious character. More frequently they have been alarming rather than destructive. While eight or ten years ago resonance was believed to be mostly of theoretical importance, engineers are now becoming alive to the fact that it constitutes a serious menace to the integrity and continuity of service of some of the long-distance lines. It unfortunately happens that, given a condition of resonance, either with the fundamental frequency or one of its harmonics, the only damping factor of any account is the ohmic resistance of the line, and the bigger the system, the less, as a rule, is this ohmic resistance; while the machines lying back of the resonant line and ready to take advantage of any favorable opportunity for raising mischief, have been steadily growing bigger and bigger, and are, of course, of the greatest capacity on the large systems. Now, we assume that most of our readers are not altogether heedless of the matter of resonance, and know full well that when the capacity and inductance of a system are of such magnitude as to bring the time constant of the circuit in tune with the fundamental frequency or with its harmonics, there is a strong probability of unpleasant results.

We wish to call attention here, however, to two facts with respect to this matter, which have not been sufficiently brought home to the average electrician. In the first place, the capacity and inductance which produce resonance are due to the entire system, not only the line. but all the translating devices that are in circuit. The capacity and the inductance of aerial lines have been the subject of much study, and their numerical values have been carefully tabulated. It is, moreover, a known fact that on most lines with which one has to deal, the capacity and inductance thus determined are not such as to be likely to lead to serious results. It is not so well understood that the generators and transformers are likely to have under certain circumstances a capacity and inductance many times greater than the line, and hence are just so much more likely to fall in with the fundamental, or with one of the lower harmonics, which are likely to be the largest. In most generators and on most systems, harmonics as high as the fifteenth can be readily found if one cares to look for them; the third and the fifth, particularly the former, are apt to be rather large, especially in the case of high voltage generators, in which for security of insulation, the coils are not sub-divided as thoroughly as in low-tension machines. Measurements of the absolute capacity and inductance of generators and transformers under various conditions and in various connections are not numerous, but is is quite easy to find capacities, for example, as great as one-half microfarad; and when one considers the probable values of this constant in large banks of raising and reducing transformers, it is not difficult to find cause for some alarm. Obviously these capacities will depend on the structure of the transformers, and particularly upon the relation of the circuits to earth.

In case of a big distribution system one is pretty certain to find frequent grounds produced by accident, even if not produced by design so far as the secondaries are concerned. Under such circumstances there is a beautiful probability of getting involved in effective resonance with capacities and inductance very much larger than those of the line itself. Consequently there is an excellent opportunity for catching resonance with the third harmonic and getting a rise of electromotive force capable of producing very interesting pyrotechnic displays about the plant. Of course, where underground cables are concerned the opportunity for this sort of thing is considerably increased, and some very striking instances of serious resonance due to one or the other of these causes have recently been brought to our attention. Equally interesting and closely connected with the phenomena just referred to, is the opportunity for resonance offered by opening the circuits, either by accident or design. This usually innocuous performance is capable of varying the constants of the circuit over a pretty wide range in such wise as to coax into materialization harmonics that usually are out of sight and out of mind. It is very much like putting one's thumb-nail firmly upon one end of a piano keyboard and drawing it rapidly and violently to the other end. The analogous electrical process is one not unlikely to furnish the experimenter a large amount of valuable information within the next ten seconds. In several instances extremely violent resonance has been observed under just such conditions, which really form a beautiful combination for bringing the capacity and inductance of the apparatus simultaneously into action for all the harmonics in the circuit. It would be a very valuable contribution to engineering knowledge if the inductance and capacity of commercial high-tension apparatus, assuming various normal and abnormal connections, should be studied and tabulated so as to give at least general information regarding the absolute magnitudes of the quantities likely to be found in the ordinary operations of power transmission. What little information has been acquired with reference to this aspect of the matter has been obtained under conditions generally imperfectly known and entirely uncontrolled, and hence is not available for the practical guidance of engineers. It is of vastly more importance, however, than the knowledge of the line constants, which we already possess.

To aid in clearing up this matter, we should be very glad to learn through the courtesy of our readers of any cases of severe apparent resonance which may come under their notice. A collection of practical data on the subject would be of very great theoretical interest and immense practical importance to those whose daily work is concerned with circuits on which such phenomena may only too readily occur.

Electric Traction on the New York Elevated.

Important tests with the third-rail system on the lines of the Manhattan Railway Company will be made before Oct. 1. General Superintendent W. E. Baker, who has had charge of the electrical construction and equipment since the change in motive power was decided on, states that at least one trial train operated by electricity will be run over a section of the Second Avenue line by that date. It will be an experimental train, and will not carry passengers. The current will be supplied by the Metropolitan Street Railway Company.

Much of the third-rail material has been delivered. Some lengths are already in place on the west side line at Park Place and near Eighty-sixth Street. The rail, which in general appearance is like a high T-rail, is one of high conductivity, and comes from the works of the Lackawanna Iron & Steel Company. The third rail lengths are 60 ft., and each is drilled with five holes at the ends, three in the web, and one in each side of the flange. One hole is for the tie-plate bolting, the others for the bonds. The rail sections will be 300 ft. Between each will be an expansion joint and flexible bond. The rail is to rest on chairs on solid vitrified tile bells, supported by an iron casting, to which they are cemented.

New York Electric Automobile Stages.

Note was made in the last issue of this journal of the plans of the Fifth Avenue Coach Company, and since then the company has received the privilege of prolonging its Fifth Avenue route, which now ends at Eighty-ninth Street, to 135th Street, and of establishing a new route from Fifth Avenue along Fifty-seventh Street to Broadway, up Broadway to Seventy-second Street, thence westerly to Central Park; and still another from Fifth Avenue along 110th Street to Cathedral Parkway, to Riverside Drive, and along Riverside Drive, joining the Broadway extension by way of Seventy-second Street.

In a recent interview on this important development, Mr. Harry Sanderson, of the Electric Vehicle Company and president of the Fifth Avenue Coach Company, said: "When we introduce the large, comfortable automobiles which are now under construction they will have a great success. They are to have both inside and outside seats, and will accommodate comfortably not fewer than 22 persons. They will be low, so that a passenger may easily step in or out from the street, and the means of ascent to the top are to be, in convenience and safety, a great improvement on the stairways of the present omnibuses. Several of these automobiles will be ready shortly for use, and the rest will be completed as soon as possible. Automobiles are admirably adapted for public conveyance over fixed routes, especially where the distances are too short to justify tramways. It is enough to say that we are alive to the possibilities, and that it is our purpose to develop them to the utmost—beginning, of course, with what we already have in hand. The electric-vehicle business is growing with great strides, and early in the autumn we shall have no fewer than 400 electric cabs in operation."

It may be noted that according to recent despatches from London, automobile omnibuses are being looked upon with favor owing to the great loss of 'bus horses from heat, and the consequent breaking down of the service on many of the routes. Besides, the interiors of the 'buses were unendurable, the windows not opening.

The Trenton Automobile Exposition.

The most important automobile exposition yet held in this country will be that of the Greater Interstate Fair at Trenton, N. J., to be held Sept. 24, 25, 26, 27, 28. The Board of Governors of the fair has wisely decided to afford all manufacturers of the United States an opportunity to show up their vehicles without any great expense, and has erected a special building for the automobile interests, with no charge for exhibition spaces. Nearly every manufacturer will be represented by several vehicles of his make, and many accessories will be exhibited. To judge at present from the applications filed with the secretary, Mr. M. R. Margerum, more than 30,000 sq. ft. will be needed.

The managers of the Trenton Fair have offered a special trophy to the Automobile Club of America to organize a club run from New York to Trenton on Sept. 22, two days previous to the opening of the fair, this trophy to be known as the New York-Trenton Cup. Another cup has been offered to the Automobile Club, of Philadelphia, to organize a club run on the same day from Philadelphia to Trenton. Only American vehicles are to participate in these runs. These offers have been accepted by the two clubs. The members of affiliated automobile clubs can participate, either in the run from New York to Trenton, or from Philadelphia to Trenton. All contesting vehicles will be on exhibition on Sept. 24, the opening day of the fair. Besides the five races organized for that day, there will be contests of automobile stopping and automobile driving between obstacles. A one-half mile driving track 66 ft. wide, with curves raised 2 ft. 7½ ins., will afford an excellent opportunity to show all the good points of the competing vehicles in the races, as well as in the other contests.

A Large Electric Cautery.

Recently, a large elm tree was to be cut down on the grounds of the Illinois Central Hospital for the Insane at Jacksonville. The crosscut saw was not long enough, and the electrician of the place passing while a consultation was being held, some one asked him to electrocute it. Not seeing the joke, he said it was "not worth while," but the farm boss, pleased with the novelty, insisted.

A pair of No. 2 weatherproof lines were run to the nearest underground feeder, and a 20-foot piece of seven-strand No. 16 iron inserted, three of the strands being taken out. A small dynamo was arranged for wide regulation of voltage, and the feeder, cut out of its usual service, was connected to it. The iron strand, heated to a dull red in the sunlight, a bright cherry in the crevice, was given a slow back-and-forth motion sufficient to admit air enough to burn the wood to soft charcoal after the water had been evaporated from it, and to allow the products of combustion to pass by.

Quite a crowd gathered to watch the unusual performance, and when the tree fell the five physicians of the hospital, who had been watching the large cautery, seemed pleased that the operation was successful, even though they knew the patient would never again stand erect.

The heating current varied from 120 to 135 amperes direct. The voltage at the machine varied from 80 to 115, and it took two hours and ten minutes to cut down the tree, which had a diameter of 42 ins. at the place cut.

The Chicago Stock Quotation Fight.

The fight between the Chicago Board of Trade and the Western Union and Postal Telegraph companies, growing out of the efforts of the Board of Trade to suppress bucketshops, culminated on Aug. 1 by the discontinuance of delivery of Chicago quotations to the telegraph companies. The breach was started by the Board of Trade demanding of the telegraph companies such exorbitant financial terms for its market quotations as rendered it impossible for the telegraph companies to comply. The latter endeavored to effect a compromise, and made a liberal counter proposition; but the Chicago Board of Trade had apparently laid out a definite course to be pursued, and it would not consider the offers of the telegraph companies. On Aug. 1 the usual Chicago quotations failed to materialize, and the speculative world outside of Chicago was guided almost altogether by New York quotations, which were substituted on all grain tickers for those of the Chicago Board of Trade. Chicago quotations came over private wires freely early in the day, but as they were evidently leaking outside, the service fell off later, due, it is supposed, to threats of the powers at Chicago. Trading, however, was conducted in New York on the first day of the fight largely on the basis of Chicago quotations obtained from private sources. What the outcome of the differences will likely be it is at present difficult to foresee, particularly since there is in the situation an element of much uncertainty in the shape of rumors of the organization of a new telegraph company for the purpose of distributing the Chicago quotations among the principal exchanges East and West. The reports with reference to the proposed new company are rather indefinite. Two or more new companies have been named as the probable successors to the older companies, but, up to the present writing, there is no evidence of any definite action in this direction having been taken. In San Francisco Chicago quotations were discontinued, save those coming by private message, but in St. Louis two bucket shops succeeded in obtaining Chicago quotations through the effect of a temporary injunction, secured by the Central Stock and Grain Exchange of Chicago against the Chicago Board of Trade. In St. Louis the speculators were much inconvenienced by the absence of official Chicago quotations.

The Paris Metropolitan Underground.

AFTER greater delay than had been expected, and following closely upon the inauguration of the deep Central London Railway, recently described in these pages, the Paris Metropolitan Underground was opened to the public on July 18, and is now being liberally patronized. The inauguration was entirely informal, so that the first train to leave Vincennes had but a single passenger. By degrees the public began to understand that the road was open for business, and later on the trains were well filled. Several stations, as, for example, that at Place de l'Etoile, being still incomplete, the number of stops is only about one-half of those to be provided later. The system must appear a revelation to the Parisians in the way of rapid transit, for, with the heavy Westinghouse 100-hp motors, a very quick start is made, and a high speed is kept up through the tunnels, as if he were cold. That this new system of travel is appreciated is shown by the fact that the first day's passengers amounted to a total of 30,000. It will, of course, be borne in mind that this present section of the Metropolitan is but one part of a huge network planned to reach ultimately every corner of the city and its nearest suburbs, practically duplicating below the surface the omnibus and street car lines that now afford such poor service.

The road itself has been built by the city of Paris, under a law which required a standard gauge of 1.44 metres (4 ft. 8½ ins.), with an over-all width of car of 7 ft. 10½ ins. and a clearance of 27 ins. between car and tunnel at a height of 6 ft. above the rails. The length of the present line in running order is seven miles, all underground except near the Bastile, where it crosses in open air above St. Martin's Canal. At the terminal stations the trains simply go around a loop and come right back into service for the return trip

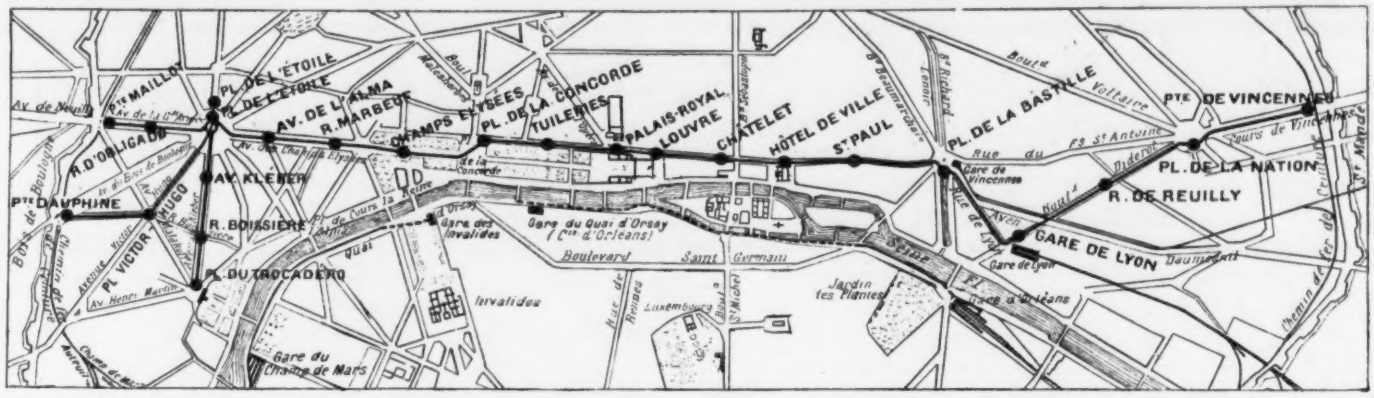


FIG. 1.—MAP OF PRESENT SECTION, PARIS METROPOLITAN UNDERGROUND RAILWAY.

the distance of seven miles between terminal points being covered in 35 minutes, including seven or eight stops. From 20 to 25 seconds is nominally allowed at each station. Trains leave every 10 minutes from Porte Maillot on the west at the Bois de Boulogne, and Porte de Vincennes on the east, each train being composed of one motor car and two trailers. The motor cars are all second class, intended to carry 28 passengers, and trailers accommodate 40 persons. Much crowding results from the present rather infrequent service, and the number of passengers carried is often determined simply by the capacity of the cars when crowded to the utmost. During the hot weather the tunnels are delightfully cool, but the transition from the heated air of the streets to the rather unexpected chilliness of the station causes many a man to turn up his coat collar and walk about without shunting. On the main line the steepest gradient is 4 per cent, and the shortest radius of curve is about 250 ft. The ordinary tunnel sections have a maximum width in the straight of nearly 23 ft. 4 ins., and a height above the rails of 14 ft. 9 ins. There are 16 stations along the line, to which should be added the two terminals, which have each two entirely distinct stations. The length of the stations is 246 ft., with a width of 45 ft., the platforms being 13 ft. wide, 3 ft. above the tracks. The average depth of the rails below the street surface is not more than 20 ft. to 25 ft., and along such thoroughfares as the Rue de Rivoli the street roadbed literally rests on the roof of the tunnel. Hence, there is not much space for ticket offices, etc., but the lowest roof gives a clearance of 6 ft. 10½ ins. The ticket office is reached by stairs from the street, the passageway

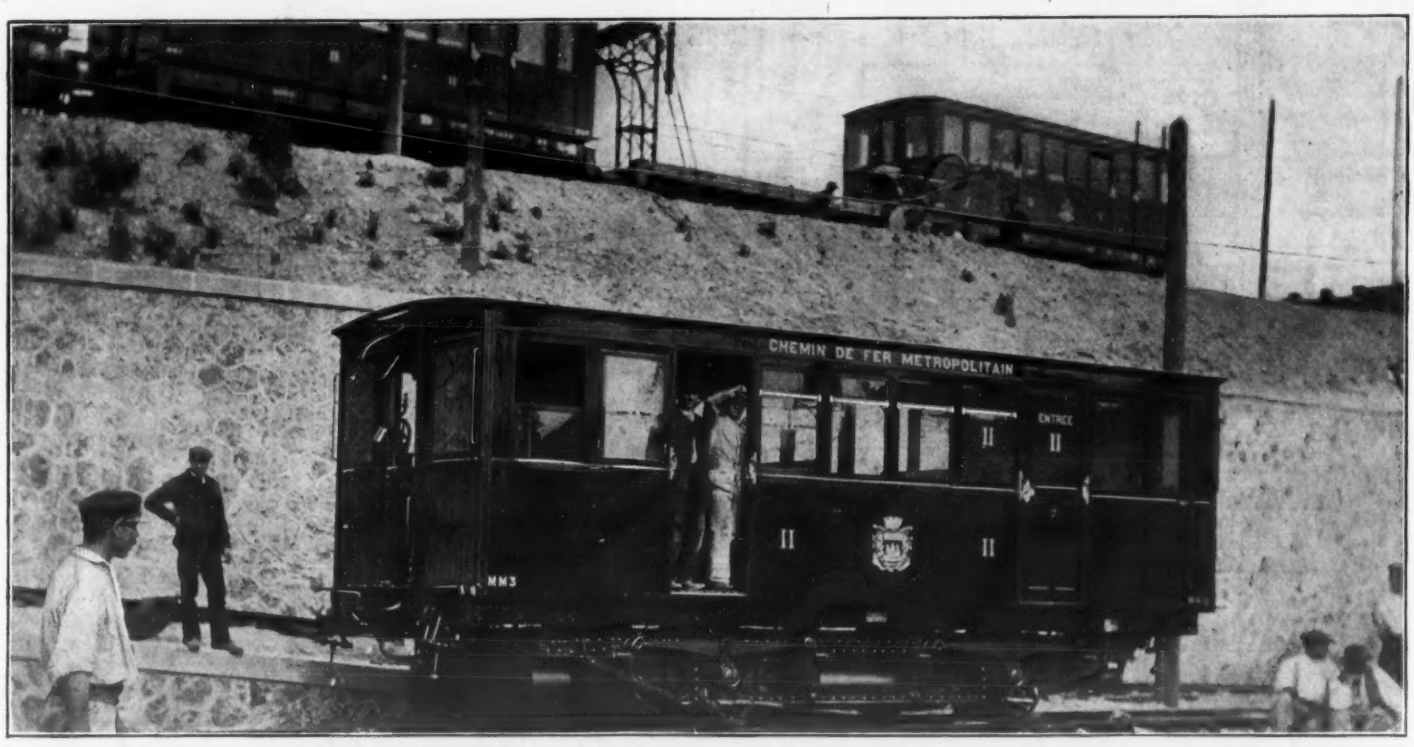


FIG. 2.—DOUBLE CONTROLLER MOTOR CAR.

lying through it to the platforms. All such halls and passages, as well as the chief stations, are lined with white enameled tile, and look very brilliant and clean with their arcs and rows of incandescent lamps, which also run out along the tunnels. In some of the stations the overhead foot-bridges giving communication between the two

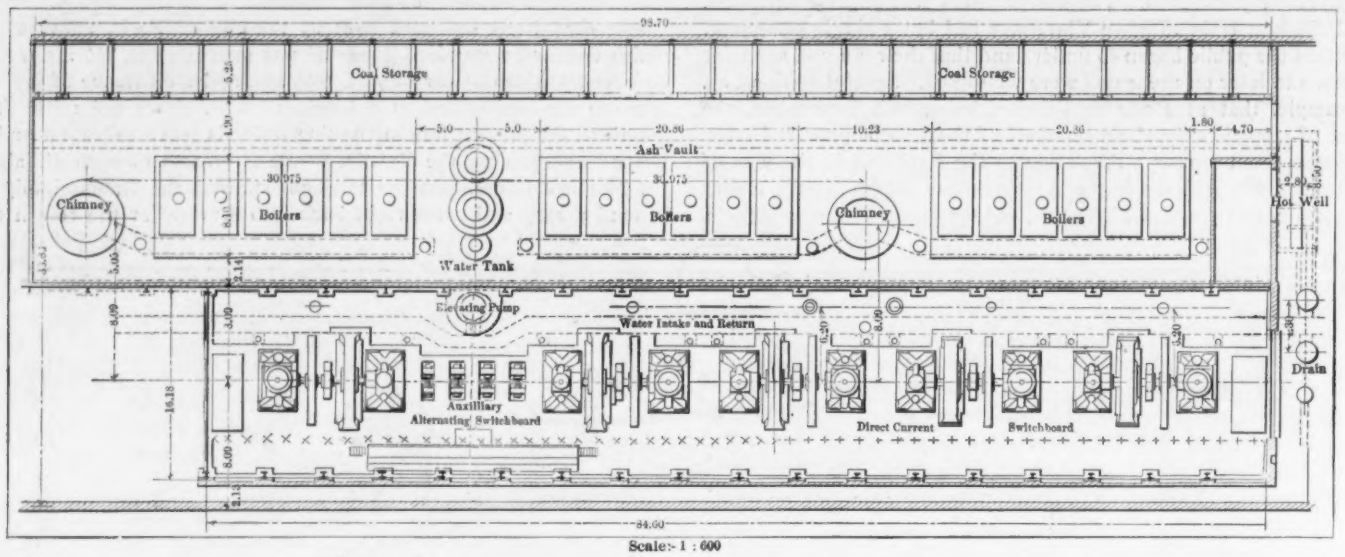


FIG. 3.—PLAN OF POWER HOUSE.

sides of a station drop quite low and clear the car roofs by a very narrow margin. At the Place de l'Etoile or Arc de Triomphe station, where several lines join, the underground work is most extensive, as provision has had to be made not only for three stations, but for an electric sub-station, storage battery rooms, etc., with two elevator pits nearly 60 ft. deep.

The rates of fare are 5 cents a trip, first class; 3 cents, second, and 4 cents, second return. No returns are issued for first class, and these second are only available before 9 a. m. for the first half of the ticket, being intended as a kind of workman's fare. The road, it will be remembered, is owned by the city and leased to the operating company, which pays to the city 1 cent on every 3 or 4-cent fare and 2 cents on every 5-cent fare. Additional to this, the company pays a tax on all passengers carried in excess of 140,000,000. The city has been to an expense of about $40,000,000 up to the present time, while the outlay for the concessionary company, on the first six lines of the network, is placed at about $10,000,000.

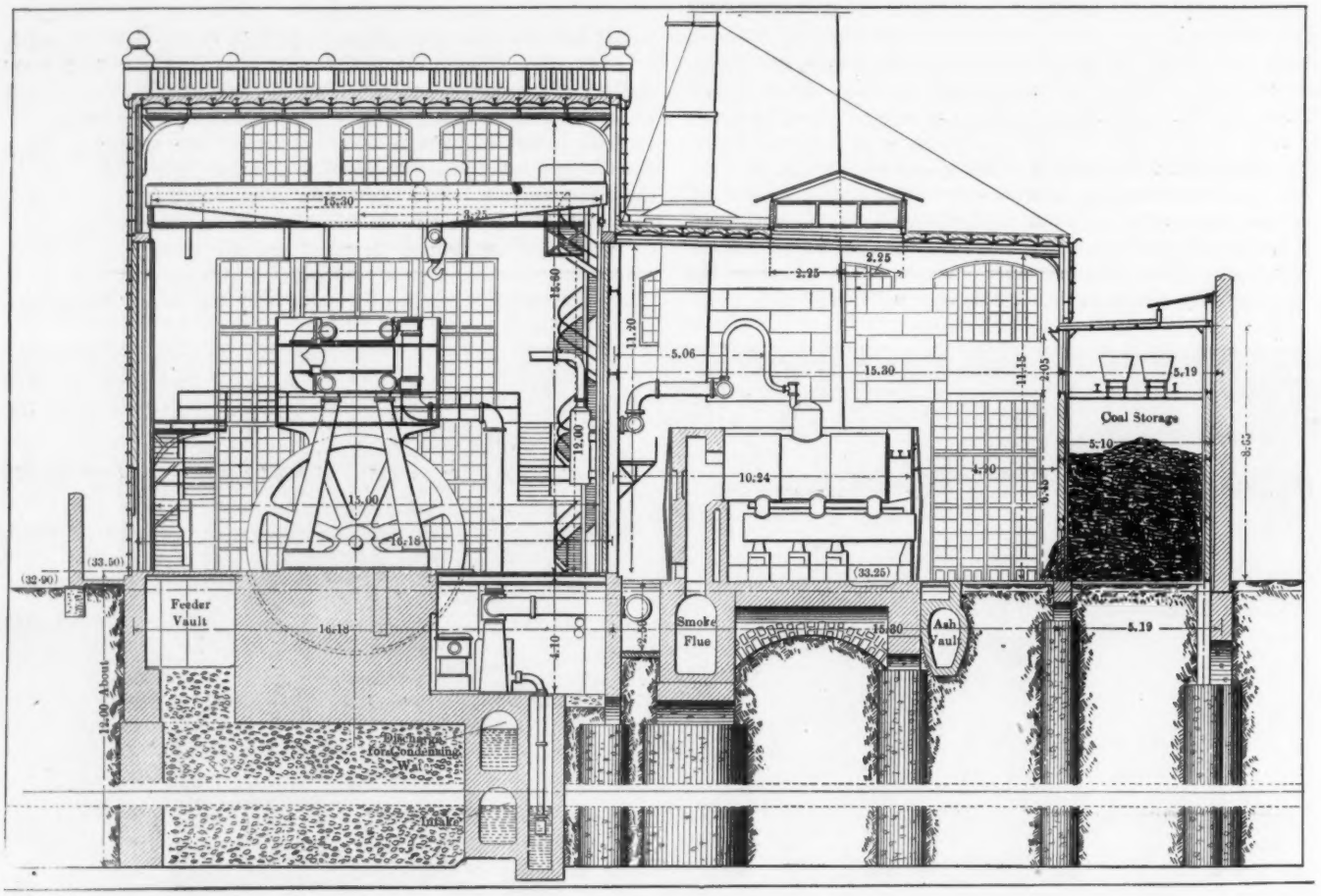


FIG. 4.—TRANSVERSE SECTION OF POWER HOUSE.

The track is laid with Vignole steel rail, each rail being about 50 ft. in length and weighing 106 lbs. to the yard. Current is conveyed by a third rail, with double head and weighing about 79 lbs. per yard. The track is laid on ties, 36 ins. between centres. Every third or

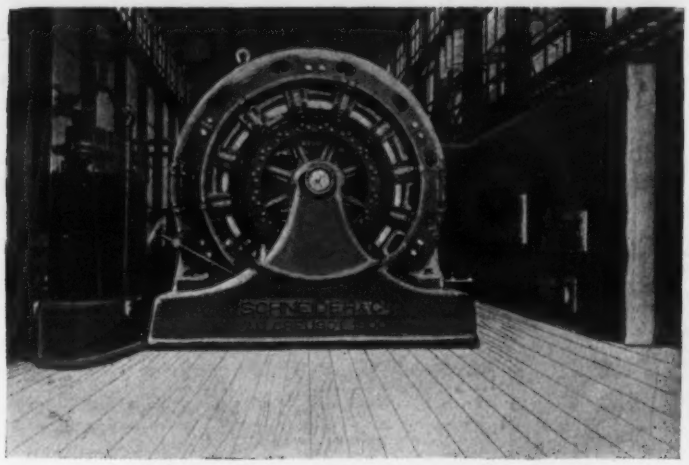


FIG. 5.—ONE OF THE GENERATORS.

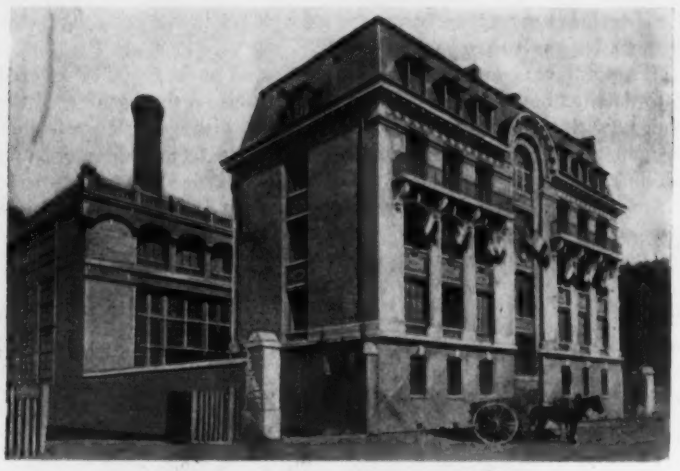


FIG. 8.—EXTERIOR VIEW OF THE POWER HOUSE.

fourth tie is lengthened on the inner end to hold the insulator for the third rail. This form of insulator consists of a cast iron chair supported on two iron pins fitted to an iron base insulated by layers of gutta-percha and protected by overhanging flanges on the chair.

Reference has already been made above to the trains. As a rule, the train consists of one motor car and two trailers, but an extra trailer is added for heavy traffic. The motor cars are all second class. The trailers are separate first and second, or combinations of the two, and are all very comfortable. The 10-minute schedule of the trains can be speeded up materially, and their movement is governed by the Dardaud electric block system. The motor cars are lighted by eight lamps of 16 candle-power, and two lamps outside at the head

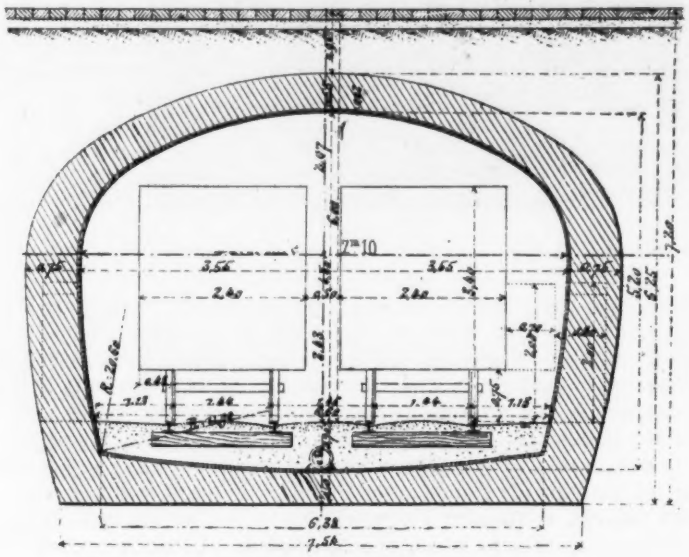


FIG. 6.—SECTION OF STANDARD TUNNEL.

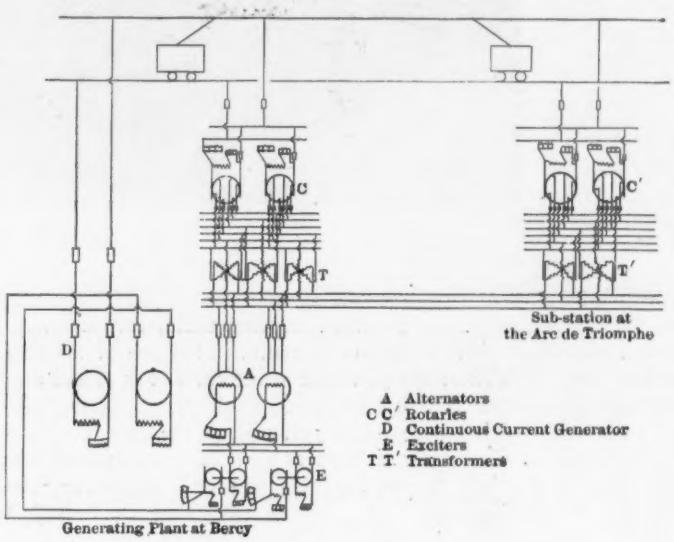


FIG. 9.—SCHEME OF ELECTRICAL DISTRIBUTION.

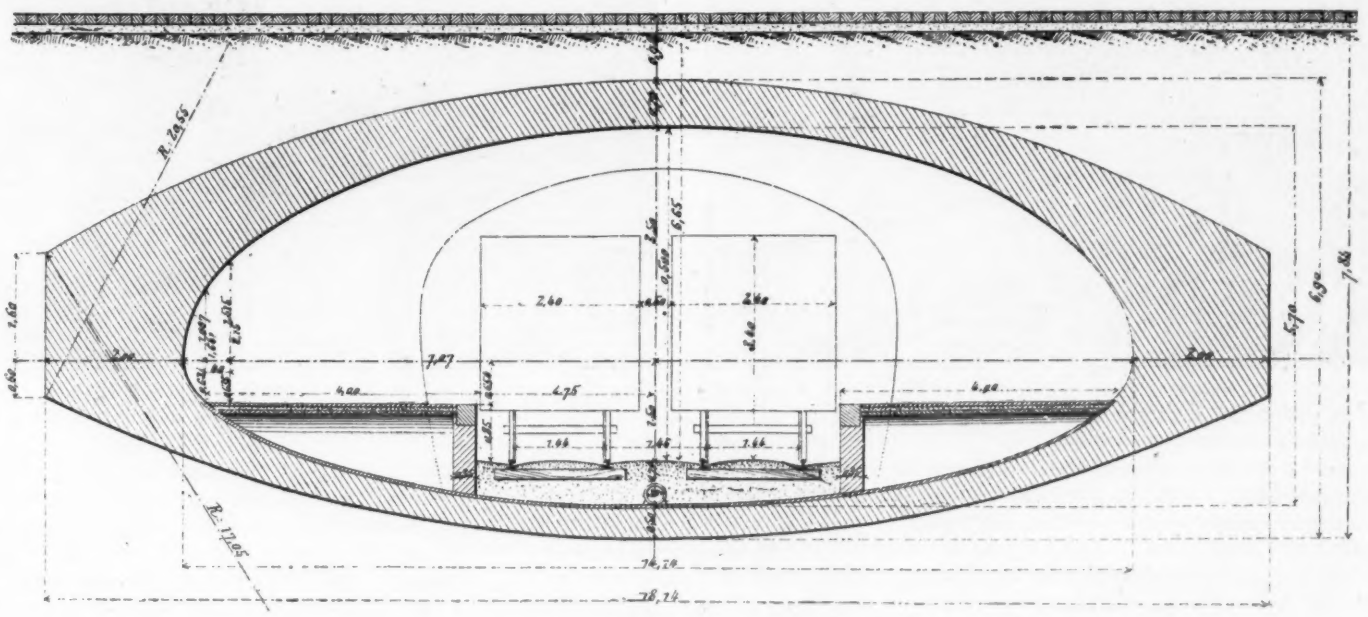


FIG. 7.—CROSS SECTION OF VAULTED STATION.

of the train. Emergency lamps are also placed in the end vestibules. Each trailer has 10 lamps.

The motor cars are 29½ ft. in length, and 46 have been ordered up to date, 22 having been delivered at the time of the opening of the road, 12 with a controller at each end, and 10 with a single controller. To help the employees distinguish motor cars from trailers readily the upper bodies of the motor cars are painted red. The trailers have a black frame. The Westinghouse Company, of France (Société Industrielle d'Electricité procédés Westinghouse), has the contract for the motors, two being provided for each motor car, mounted as shown in one of the illustrations herewith. They are of 110 horse-power each. In a short compartment at the car end is placed a new standard 98A Westinghouse controller. In the compartment roof is an automatic circuit breaker, car type, and on the side is a toggle-jointed fuse box carrying a copper wire fuse, easily renewable. Adjacent to this is a Wurts lightning arrester. All these details, etc., are of Westinghouse make, but the air-brakes are French, the compressor being operated by small Amelin & Renaud motors. The motor car contacts with the third rail are obtained by two shoes of double-link pattern, and around the car depot, overhead wires are resorted to. Two wires are used there, on which a four-wheeled carriage runs, passing through the loop-shaped supports. A cable from this carriage is fitted with a plug which can be pressed into a socket on the motor car, thus affording a means of connection to the controller and motors.

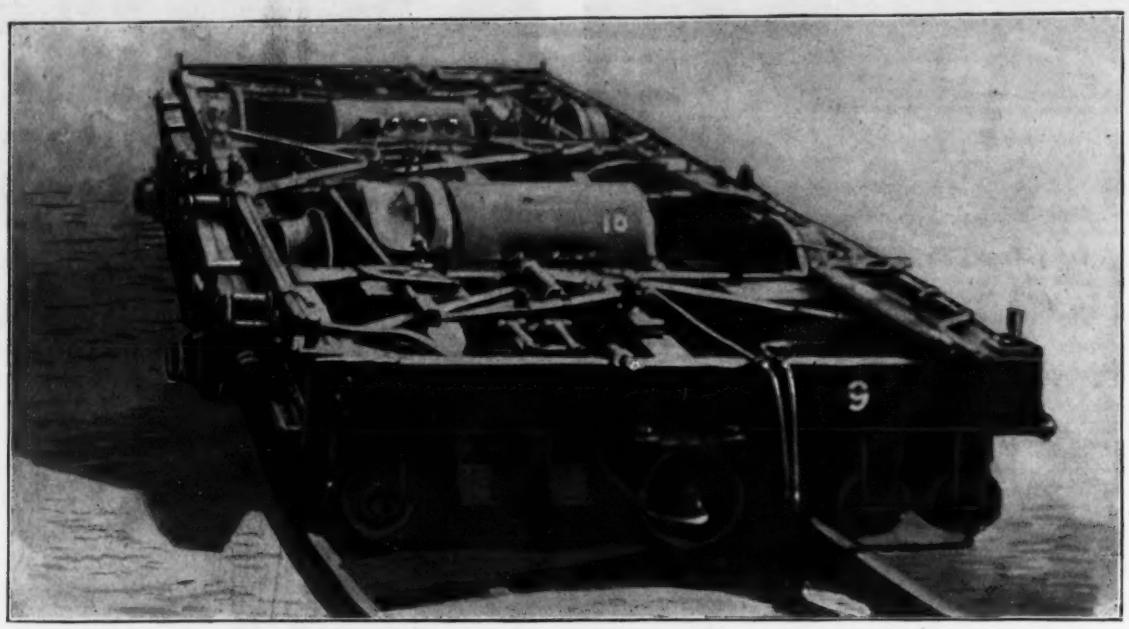


FIG. 10.—TRUCK OF MOTOR CAR.

At the present time the Bercy power house, of which and the offices an exterior view is here shown, is in course of construction near the Lyons station, on the Quai de la Rappé, bordering the Seine, and until it is finished current is obtained from one or two outside sources, alternating and continuous, and delivered to the line at 550-600 volts. The whole of the central power house equipment is being furnished by the well-known Schneider Company, of Creusot, and will consist chiefly of four generator sets of engines and three-phase alternator, 3000 horse-power each; 5000 volts, and 25 periods. A general plan is given herewith of the power house and of the scheme of distribution. Between Vincennes and the Louvre station current will be delivered normally by a direct current unit of 1500 kilowatts at 600 volts, but in case of necessity that section can be supplied by means of the three-phase system through the statics and rotaries, as indicated at *T* and *C*, Fig. 9. The further western portion of the line is to be fed from the sub-station at the Place de l'Etoile, through the statics and rotaries as shown. There will be in this sub-station, in large vaulted chambers to which the three-phase current is brought by heavily insulated cable along the line, nine static transformers of 250 kilowatts each stepping-down the 5000-volt current to 430 volts for the three rotary converters of 750 kilowatts delivering 600-volt current to the line; 2 "boosters" of 250 kilowatts, 600 volts to 100 volts; one battery of 250 Tudor accumulators of 1800 ampere-hour capacity, stored through the boosters. There is, by the way, to be another set of Tudor batteries at the Bercy power house. The sub-station statics and rotaries are also of Schneider construction.

At the Bercy power house the continuous and alternating-current

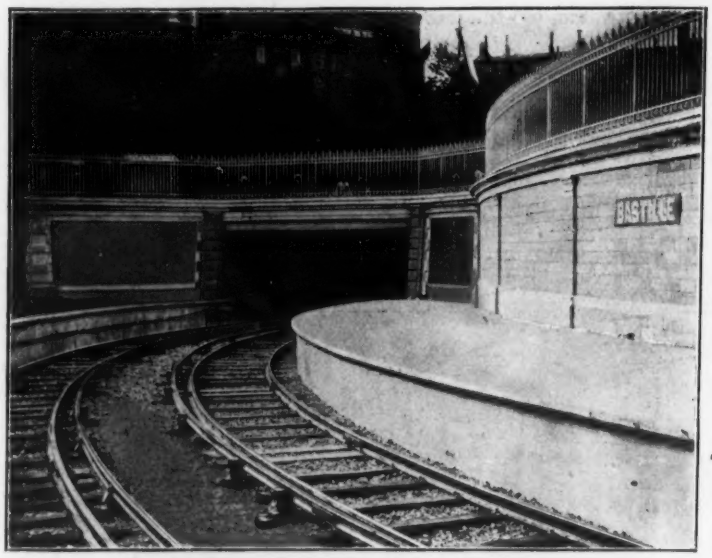


FIG. 11.—BASTILLE STATION, SHOWING THIRD RAIL.

FIG. 12.—TUNNEL AT LYONS STATION.

generators are alike driven at 70 r. p. m. by compound condensing vertical engines, direct-connected. The alternators have a revolving field. Excitation current is delivered from two sets of exciters, one of which will be in reserve; each group formed of two continuous-current machines, one running as a motor on 600-volt current and the other as generator furnishing current at 200 volts. These are 50-kw units, and run at 525 r. p. m. The rotary converters operate at a speed of 250 r. p. m. At the Place de l'Etoile sub-station the two elevators will be hydraulic, but there will be two Rateau ventilating blowers driven by electric motors, and each capable of delivering 10,000 cubic metres of air per hour. The Bercy power house contains 18 boilers already in place, divided in three groups of six each, of semi-tubular type, with two lower and one larger upper drum. The engines to which steam is delivered are condensing, as noted, but can operate with free exhaust if necessary, and have Corliss valve motion, the dynamo being situated between the two cranks. The engines are rated at 2600 horse-power each.

Electrolytic Interrupters.

BY BENJ. F. BAILEY.

IN the Caldwell electrolytic interrupter we have a symmetrical arrangement, the break being caused by the passage of the current through the small hole in the glass partition wall. Hence, we should expect that when on an alternating circuit the action in the two directions would be the same, *i. e.*, we should expect to find a break in each half of the wave, and this is actually found to be the case. In every instance the two halves of the wave were found precisely alike within the limits of experimental error. This statement, as well as others, applies to a much greater number of cases than

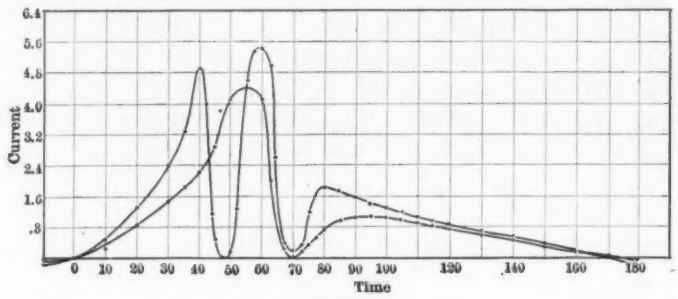


FIG. 1.

those of which curves were actually taken, as with the arrangement used by the writer it was the work of but a couple of minutes to run through the curve and get an approximate idea of the wave shape, whether or not more than one break occurred in each wave, whether or not the curve touched zero at the break, etc.

It will be remembered that with the Wehnelt interrupter the breaks were seldom complete. In the Caldwell, the break is sometimes complete, sometimes not, but the time during which there was zero current seldom lasted longer than 1-5000 sec. One interrupter used was adjustable. It had a rather large hole into which a fine-pointed glass rod could be inserted and the size of the aperture thus regulated. This seldom or never gave a complete break, doubtless on account of the irregular crescent-shaped aperture, caused by the insertion of the rod. With an interrupter having a single small, smooth hole, the break was usually complete.

Of course, so far as its use in connection with an induction coil is concerned, it matters little whether the break is total or not, since the induced e m. f. is proportional to the rate of change of the magnetic flux, which is again nearly proportional to the rate of change of the current. Of course, if the iron core be worked at a very high flux density, it would be advantageous to have the break complete, as the rate of change of flux with current would be greater with small values of current.

Another respect in which there is a difference between the Wehnelt and Caldwell interrupters, is in the number of breaks in each wave. In the Wehnelt I have not succeeded with any arrangement of self-induction and resistance in getting more than one break in each wave; in the Caldwell this was quite readily done.

Fig. 1 shows two typical curves. They were taken with an interrupter having a smooth hole .2 mm in diameter. The current was about 2 amperes at 150 volts and 40 cycles per second. The self-induction of the circuit was 0.062 henrys. The first part of the curve follows quite closely the curve of applied e. m. f. The break is quite rapid, taking about 1-1800 second and is complete, the length of time during which there is zero current being about 1-7000 second. The current then rises again to about one-third its greatest value and then gradually and steadily decreases to zero. The other half of the curve agrees exactly with this one.

Plotted over this curve is one taken immediately after, everything being exactly the same except that the self-induction was reduced to 50 turns instead of 300, or 1-36 as much as before. The zeros of the two curves coincide almost exactly. The second curve, of course, rises much more rapidly than the first on account of the lessened impedance of the circuit. The break occurs at about the end of the first quarter of the curve. The current immediately rises again and there is a second break a little before the middle of the curve. The current then rises again and dies away as before. The first break is complete, the second not quite so. The "make" after the first "break" is fully as quick as the break, in fact, the curve during the breaks is very much like a sine curve displaced vertically.

In Fig. 2 we have two curves of the adjustable interrupter before described. Here we had 300 turns (0.0640 henrys) self-induction, as in the first curve of Fig. 1, and the curves corres-

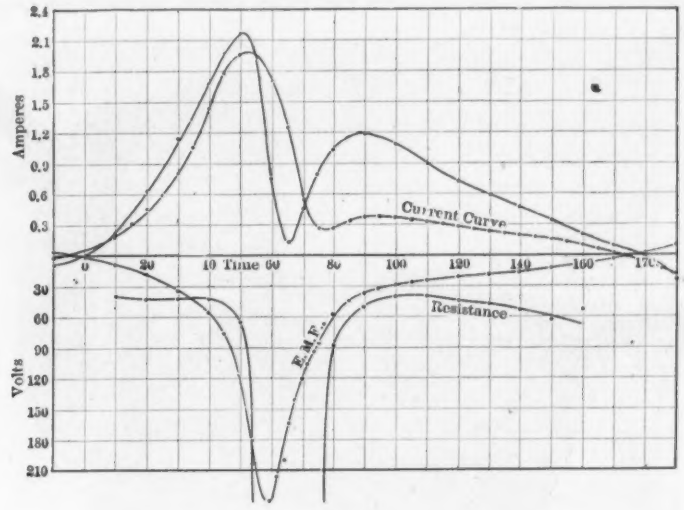


FIG. 2.

pond quite closely. The zeros and the points of the break agree, but the break is not quite so sudden and is not complete.

In the same figure is plotted the curve of e. m. f. over the interrupter corresponding to the more peaked of the two current curves. It is purposely reversed to avoid confusion of lines. At first its shape corresponds to that of the current curve, showing again that the "capacity effect" of the interrupter is due to the break, as the interrupter during this part of the curve is non-inductive. The peak of the e. m. f. curve falls opposite the point of maximum slope of the current curve. It corresponds to a voltage of 240 and its great value is, of course, due to the self-induction of the circuit.

The curve of apparent resistance whose points are found by dividing the instantaneous e. m. f. by the instantaneous current, is also plotted. It is approximately horizontal except at the break, when it rises very rapidly. It has apparently a slight rise for small values of the current, but this cannot be definitely stated on account of the smallness of the quantities involved as numerator and denominator. We might expect such a rise on account of the fact that the cell, of course, polarizes somewhat and this raises the e. m. f a greater amount proportionally than with large values of the strictly I R drop. In other words, it is a small constant added to the e. m. f. curve, thus distorting it slightly. The other current curve in Fig. 2 was taken with the adjustable interrupter using 150 turns. It is a type of curve in which the break is still further from being complete.

DIRECT-CURRENT CURVES.

The method of curve-tracing, described in a previous article, is applicable to all alternating-current curves, provided all waves

are of the same or almost the same shape. The fundamental principle of the device employed is that it shall make one revolution, or a certain fraction of one, for each cycle of current.

When we come to direct-current work, such as obtaining the curve of current of an induction coil or interrupter on a direct current, the method as given in a previous article cannot be used. For such work the only method used has been the employment of some device in the shape of a galvanometer having a frequency of vibration of 3000 or more per second. Such a galvanometer will give a deflection very nearly proportional to the current flowing at that instant, and will follow quite accurately all the variations of the current, provided they take place slowly compared to the frequency of vibration of the needle. By reflecting light from the vibrating mirror upon a falling photographic plate a curve of the current can be obtained. This method has several disadvantages. The apparatus is costly, and rather apt to get out of adjustment. The constant may vary from time to time, and the curves upon the plates need to be transferred to cross section paper to give more definite information. There is no simple method of obtaining the velocity of the falling plate, so that the time represented by a unit of length along the axis may be uncertain. In the work here referred to I think there is no doubt that some of the changes took place altogether too rapidly for the galvanometer to follow them. One case, however, where it has the field to itself, is in investigating the differences between succeeding waves, since this method gives us one or more particular waves, and not an average of several waves.

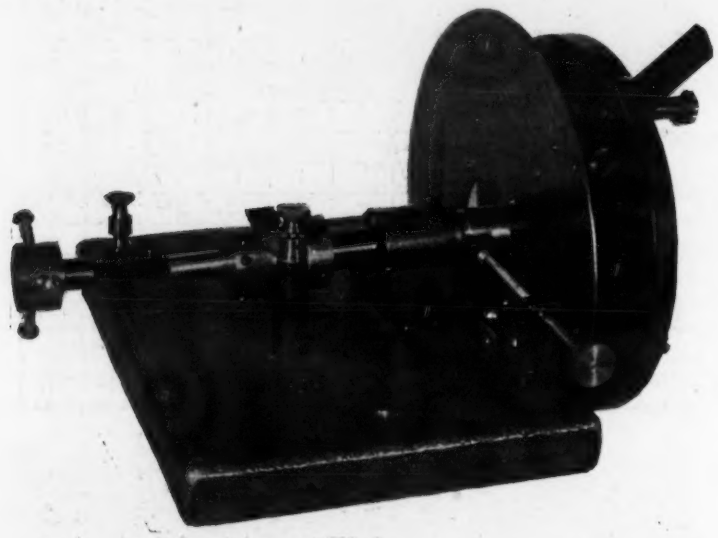


FIG. 3.

A method that will enable one to use the ordinary contact-maker upon direct-current curves is desirable, and such a device was used in the following work. The instrument is illustrated in Fig. 3. It may be called an arrangement for automatically synchronizing the contact-maker with the waves of current at a certain point in each revolution, and depends upon the regularity of the action to keep up the synchronism for the rest of the revolution. The only change made was to mount upon the shaft of the contact-maker a brass contact ring, with an insulated brush resting upon it. A section of about one-third of the circumference was cut out of the brass ring. The contact-maker is driven by a small motor or other device capable of maintaining a uniform speed, but which can be varied to suit the case in hand. The instrument to be investigated is connected up in the usual way, the current, however, passing through the brush, the brass ring, the frame of the machines, and out. It is evident, then, that the device, say an interrupter, will be in operation during only two-thirds of each revolution. The circuit will then be broken during the remaining third, and will then be again made. The closing of the circuit always occurs at the same point of revolution. Hence, if the waves of current be regular and the speed of the contact-maker uniform, a certain value of the current will always occur at a certain point in the revolution, and we can use the contact-maker for finding these values the same as usual with the alternating-current. The speed of the contact-maker is regulated so that from three to five complete cycles occur during one revolution of the contact-maker.

With the instrument as described, since contact is made through the base, it is necessary to have the part of the circuit over which the drop of potential is taken next to the contact-maker, since otherwise we should make a short circuit around part of the apparatus in connecting up. For this reason it would be better to have two brushes resting on an insulated brass cylinder. This would also distribute the spark on breaking the circuit over two gaps instead of one.

This device was found to work very well, and is applicable to a great many problems, such as finding the curves of charge and discharge of condensers, inductive resistances, etc. It also gives an easy method of measuring the time constant of a circuit. In the case of the interrupter it was found that one could always obtain reliable readings from the first three or four waves after the contact, and these were sufficient for our purpose. The only point that gave any trouble was the variation in speed of the motor used. This could be remedied by using a larger motor with a tachometer and an observer to regulate the speed.

The first curve, Fig. 4, is that of the Wehnelt interrupter, the applied e. m. f. being 220 volts, current about 3 amperes, 1500 turns self-induction and an induction coil in circuit. The curve is not that of the first wave after contact is made at the synchronizing device, but the second, as the first one differs somewhat from the standard shape. The total time of one wave was almost exactly 1-400 of a second, the time of breaking 1-1600 second, and the time during which the current remained zero, about 1-8000 second.

The e. m. f. curve is plotted on the same diagram. It runs along

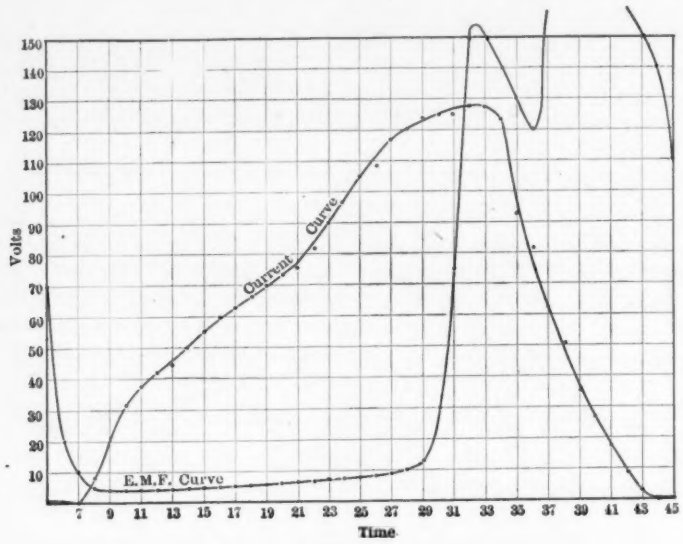


FIG. 4.

at a low value, becoming gradually greater as the current increases till the break occurs, when it runs up to an extremely high value. The deflections here were very unsteady and at the peak were off the scale, so this part of the curve must be regarded as only approximate. The maximum voltage, however, was in the neighborhood of 600 volts.

This helps to explain the curious fact that if a direct-current and an alternating-current voltmeter be connected over the interrupter, the alternating-current instrument reads much the higher. In one case the direct-current instrument showed 41 volts, the other 76.5. With about eight times as much self-induction, the numbers were 25.5 and 117, or nearly 1 to 5. The applied voltage was only 70. This might be due to oscillations, but no case that we have investigated shows any trace of such. The extreme irregularity of the curve is, however, enough to explain the difference. The e. m. f. is all directed in one way, but the direct-current instrument reads average values while the other gives square root of mean square values. On anything but a constant direct-current the latter will be higher. Thus, in the case of the e. m. f. curve just given, the mean value of their ordinates taken from the curve is 148, while the square root of their mean square is 295, or about twice as much. The difference between the two increases with the irregularity of the curve, hence it increases in general with increased self-induction. In the table given later will be found the values of the two readings for various self-inductances and currents.

Fig. 5 shows the current curve for a Caldwell interrupter, the applied e. m. f. being 220 volts, current about 4 amperes, inductance

1038 turns. In the curve we have the first two waves of current. By comparing the two it is seen that the rise of current is much sharper in the first. In this the orifice is, of course, full of liquid and the first part of the curve is that of the rise of current in an inductive circuit. The fact that the shape of the first part of the second curve is different is due probably to the fact that the liquid runs into the hole and establishes contact first at a point instead of over the whole of the orifice. This view is supported by the fact that except for the first third of the rise, the two curves agree. The curve is flatter on top than the Wehnelt curve. The frequency is somewhat higher, being 655 per second. The time of break is 1-1800 second and the time of zero current 1-3900 second. On the same sheet is plotted the curve for a Wehnelt interrupter, in which the interruptions are not complete, the minimum value of the current being about one-third the maximum.

Fig. 4 furnishes us with the explanation of another curious fact. A great point that has been made against the electrolytic interrupter is its apparent large consumption of power. Generally, with a direct-current the power expended in any part of the circuit is the product of the volts and the amperes, and many writers have assumed that this applied to the interrupter. This is, of course, not the case, as the rule applies only to steady currents or, if unsteady, when taken over a non-inductive resistance. The mistake may have arisen from the fact that the interrupter, *per se*, is practically non-inductive. However, as we have already seen, the interrupting action causes it to act like a capacity, so that when interrupting it is highly inductive. Thus, in the present case, the average value of the current, which is almost ex-

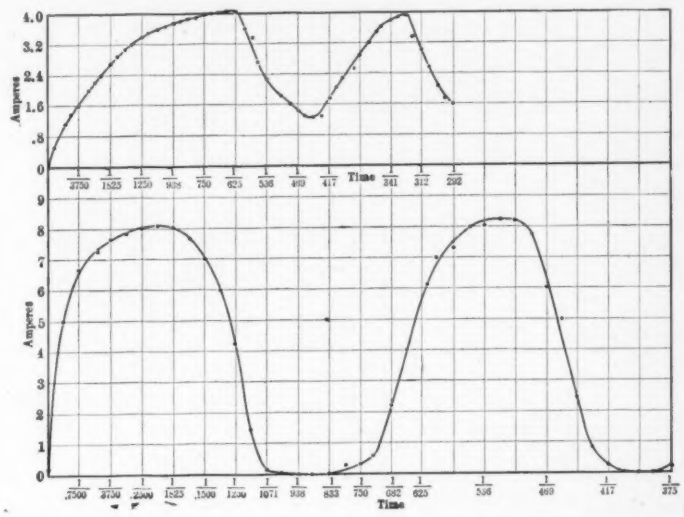


FIG. 5.

actly the same as the square root of the mean square value since the variation is fairly regular, is 1.26 amperes. The average value of the voltage is 59 and the square root of mean square value 95 volts. Thus the apparent watts are 74.4 and 118.4, respectively. The true wattage found by multiplying the instantaneous value of current and e. m. f. together is only 46.4 and this is by no means an extreme case. The explanation is, of course, simply that the peaks of the e. m. f. and current curves do not occur simultaneously; in other words, they are not in phase. The well-known rule for sine curves of current is power = volts × amperes × cosine of angle of lead or lag. Of course, these are not sine waves, but we can consider them as reduced to equivalent sinusoids and figure the angle of lead, thus getting an approximate idea of the displacement. This will not be exact, as even if the displacement were 90°, the power would not reduce to zero. Finding the angle in this way, we get for this case an angle of lead of 67°.

This was tested experimentally by connecting up an interrupter and measuring the actual power consumed by means of a Weston wattmeter. The current was measured at the same time by means of an electrodynamometer, and the voltage both by means of a direct-current and an alternating-current voltmeter. Below is a table showing the quantities for an interrupter working on 70 volts direct-current. The column marked $E_d\ I$ is the product of the amperes, and the readings of the direct-current voltmeter. Similarly, the $E_a\ I$ column is the same, using the alternating-current voltmeter readings. This column is the real apparent watts; the other is simply given for comparison, and the value $E_a\ I$ is used in calculating the angle of lead.

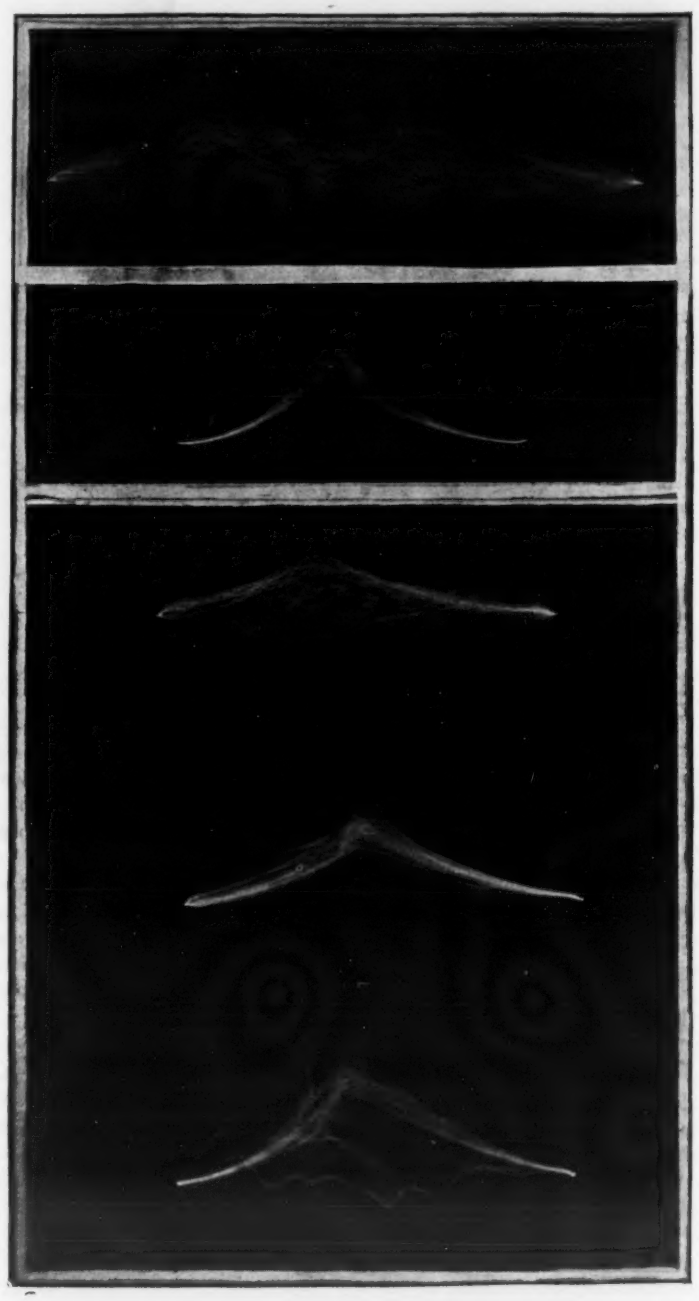
Amp.	Volts A. C.	Volts D. C.	Turns	Watts	E_d I.	E_a I.	Angle of Lead
6.08	76.5	41	75	145	249	465	72°
6.08	91	41	100	153	249	553	74°
4.95	106.5	44	150	127	218	532	76°
4.74	117	25.5	200	109	121	555	79°

Or course, the same thing applies to an interrupter working on an alternating current. In this case the readings of voltage were taken only with the alternating-current voltmeter. Below are the figures for a large-sized interrupter, working on 53 volts alternating current:

Turns	Amp.	Volts	E I	Watts	Angle of Lead
25	8.58	54.2	465	250	57½°
50	8.20	55.5	455	236	58½°
75	4.27	67	301	225	41.6°
100	4.02	75	286	230	36.5°

The figures for a smaller interrupter are given below:

Turns	Amp.	Volts	E I	Watts	Angle of Lead
50	4	57.3	229.2	130.	55.2°
100	2.93	70	205.1	88	64.3°
150	2.92	61	178.1	80	63.2°



FIGS. 6, 7 AND 8.

The angle of lead is usually about 60°, or the real loss in the interrupter is half the apparent loss.

With the curve-tracer used it was easy to trace the variations in the line-pressure caused by the action of the interrupter. These seem to be due simply to the fact that the supply circuit is part of the interrupter-circuit and possesses considerable resistance and impedance for such large currents. At the point of maximum current the pressure was considerably below, and at the break it rose somewhat above the normal. For this reason the applied voltage should preferably be measured with an alternating-current instrument. This may explain the fact that some investigators have found that lamps on a circuit were lighted more brilliantly than usual when the measured voltage was only normal, in which case the voltage was probably measured with a direct-current voltmeter.

There is a wide field for the study of the various forms of discharges from an induction coil operated by means of the electrolytic interrupter. We have not gone deeply into this phase of the subject and merely show here a few typical forms. The camera was focused on the discharge points, the plate inserted and the slide and cap removed. The exposure was made by closing the circuit for about a second. The e. m. f. was 220 volts, current about 10 amperes. The new adjustable Wehnelt interrupter was used.

The first, Fig. 6, merely shows the ordinary spark discharge when

FIG. 9.

the apparatus was working well. The separation of the points was 10 inches. The positive pole in this, as well as in the other pictures, is at the left, the negative at the right. There is a tendency to form a glow at the positive pole.

In Fig. 7 the conditions were the same, except that the poles were only 4 ins. apart. Under these conditions an arc forms instead of the spark discharge, and its centre is carried up by the heated air. It is probable that here the e. m. f. induced at the make is sufficient to bridge the gap in the opposite direction, producing a true alternating-current arc.

Fig. 8 shows the transition of one form to the other. The conditions in all three were the same, except that the inductance was changed. In the upper one 110 turns were in circuit. This shows just a slight tendency to form an arc. In the middle one 50 turns were used, greatly increasing the frequency and induced e. m. f. In the lowest but 10 turns were used, and we then have the true alternating arc. In addition to the given inductance was the unknown inductance of the coil.

Two pictures were taken showing successive discharges in order. The negatives show the discharges plainly, but are not good enough for reproduction. They were taken by the primitive device of merely rotating the camera by hand through a sufficient arc to cover the whole plate with successive sparks, the discharge passing regularly while this was being done. This method, with better-arranged apparatus, would give a convenient means of studying these discharges.

The first one taken showed the ordinary spark discharge, and each spark picks its own path independent of the preceding ones. The second one was a picture of the arc discharge. In this, each separate discharge follows closely in shape the one that came before it. Small ripples travel along the discharge in this case, all apparently in the same direction.

In Fig. 9 is illustrated the Caldwell interrupter used. A small coil of lead pipe is used for one electrode so that the interrupter can be cooled by passing water through this pipe. The other is simply a strip of lead. The two are separated by a thin glass tumbler with a 2 mm hole drilled in the bottom. A glass rod with a fine tapering point can be inserted more or less in this hole, so as to vary its size. A better arrangement would be to have several holes of different sizes. All but one should be covered by a disk, capable of being rotated so as to open any desired hole. If the vessels are made large and their diameters in the ratio 1.41 to 1, there will be no trouble from the liquid rising in one or the other. Such an interrupter will work perfectly and give no trouble whatever, except possibly from a very gradual enlargement of the holes.

Standing beside the jar is the anode of a Wehnelt interrupter, which I think is an improvement on any yet brought out. A piece of capillary tubing about 1¼ ins. long is fused to the end of a larger tube, as shown. The platinum point, which should fit the bore of the capillary rather closely, is soldered to the end of a heavy copper wire and passed down through a cork in the top of the tube. This interrupter is adjustable and gives no trouble by cracking out of the glass. The liquid rises in the well-known manner in the tube, but by making the top connection tight this causes no trouble. By cutting a thread on the rod and passing it through a metal cap, the instrument could be more easily adjusted. If made with No. 18 platinum wire it will readily carry 8 amperes. The discharges shown above were made with the aid of this interrupter.

Tests of Street Car Brakes.

The New York State Board of Railroad Commissioners has made public its report on the official tests which it made recently of automatic brakes for street surface cars. The commission states that while the results of the tests were very satisfactory, there is still room for much improvement, and the board feels that its action in holding a public test will result in still further improvements in brakes or in new inventions which will reduce the distance within which a car can now be stopped, and it has the satisfaction of knowing that it has done all in its power to bring about the adoption of better brakes than those now used by the majority of roads in this State, and thus reduce the number of accidents.

After carefully considering the various points in each system and adding to or taking from the mechanical standing of the different brakes, as given in the report of the electrical experts, the board gives the several brakes the following final standing in the order of their respective merit: The Electric Selector & Signal Company, the Peckham Motor, Truck & Wheel Company, the Sterling Supply & Manufacturing Company, the G. P. Magann Air-Brake Company, M. H. Vogel, the Devlin Street Car Brake Company, the J. G. Brill Company, the Sauvage Street Car Brake Company, the Standard Air-Brake Company, the Christensen Engineering Company, the General Electric Company, J. E. Reyburn, the Columbia Car Light & Brake Company, Price, Darling & Co., the Safety Appliance Company, Bach & Schlegal.

After a careful consideration of the whole subject of brakes for electric cars, the board has determined that, except in special cases where the liability of accident is very remote, the ordinary single chain and spindle hand brakes, now generally used, should be replaced by brakes made by one of the following manufacturers, or any other which, in the judgment of the board, is hereafter shown to be equally efficient:

Air-brakes—The G. P. Magann Air-Brake Company, the Standard Air-Brake Company, the Christensen Engineering Company, J. E. Reyburn. Electric brakes—The Electric Selector & Signal Company, the General Electric Company. Friction brakes—The Peckham Motor, Truck & Wheel Company, the J. G. Brill Company. Hand-power brakes—The Sterling Supply & Manufacturing Company, M. H. Vogel, the Sauvage Street Car Brake Company.

The Western Electric Company's Exhibits, Paris Exposition.

The Western Electric Company has a very extensive exhibit on the ground floor of Electricity Building, close to the great switchboards, where are shown telephone and telegraph apparatus, dynamos and motors, switchboards, arc lamps, cables, etc. This is, in fact, by long odds the most comprehensive exhibit in the American electrical section, and gives a vivid idea of the variety of products turned out by this firm, as well as of the extensiveness of its business and of the quality of the goods. Moreover, the apparatus on exhibition is shown in operation wherever possible.

The space occupied by the Western Electric Company fronts right along the main aisle of Electricity Building, and is, therefore, located very favorably. The most prominent section of the space is given up to a telephone exchange of 18,000 lines, shown in operation. The telephone exchange is on the common battery system, the operating current being furnished by a storage battery of 11 cells. These cells are charged from the 220-volt distributing mains of Electricity Building by means of two twin motor charging generators, furnishing 40 amperes at from 20 to 30 volts, between which limits the pressure can be regulated. One of these machines is sufficient for charging, and the other one is in reserve. The generators of these charging sets are of special construction, with many-sectioned commutators and carefully shaped pole shoes, which admits of running them in parallel with the battery on the lines.

A number of telephone instruments have been distributed by the company in the American section of Groups IV. and V., both on the ground floor and in the gallery, and also in the American Machinery Building at Vincennes. The exchange is connected to the central exchange of Paris by three lines, so that exhibitors in the American section, including the ELECTRICAL WORLD AND ENGINEER, have, therefore, telephonic connection with all the subscribers throughout Paris. The signaling is effected by means of two ringing dynamotors with busy-back and tone-test attachments, one of which is run from the 220-volt mains and the other one from the storage battery mentioned above. Besides the exchange, there is shown an exhibit of wall, desk and table telephone instruments, for the common battery system, and also magneto instruments for exchange and private lines.

In the line of telegraphy there are shown a complete set of instruments, with a fifty-line switchboard, as used in New York. This switchboard is provided both with the peg switch and with wedge cut-out. In a showcase are placed line keys, connection posts and other telegraph specialties, as well as a portable testing set and single testing instruments. The exhibit also contains a complete line of fire-alarm apparatus, in working position, and consisting of both key and keyless boxes. The system thus illustrated is that in actual use in the city of Chicago.

A complete line of street railway line supplies and cables and cable tools are also shown. These are mounted on cloth-lined exhibition boards.

An electric lighting and motor distribution plant is also shown in operation. It consists of a 6 P. L. 75-kw 110-volt generator, directly driven by a motor of the same type, but wound for 220 volts. Motor and generator are mounted on the same sub-base. The switchboard used in connection with this set has panels of white Tennessee marble, and is designed for six lighting and six motor circuits. The connections at the back of the board are made by copper bars of rectangular cross-section, consituting a job of extraordinary neatness and regularity, and representative of the best American practice. The back of the board is in plain view of those passing through one of the transverse aisles.

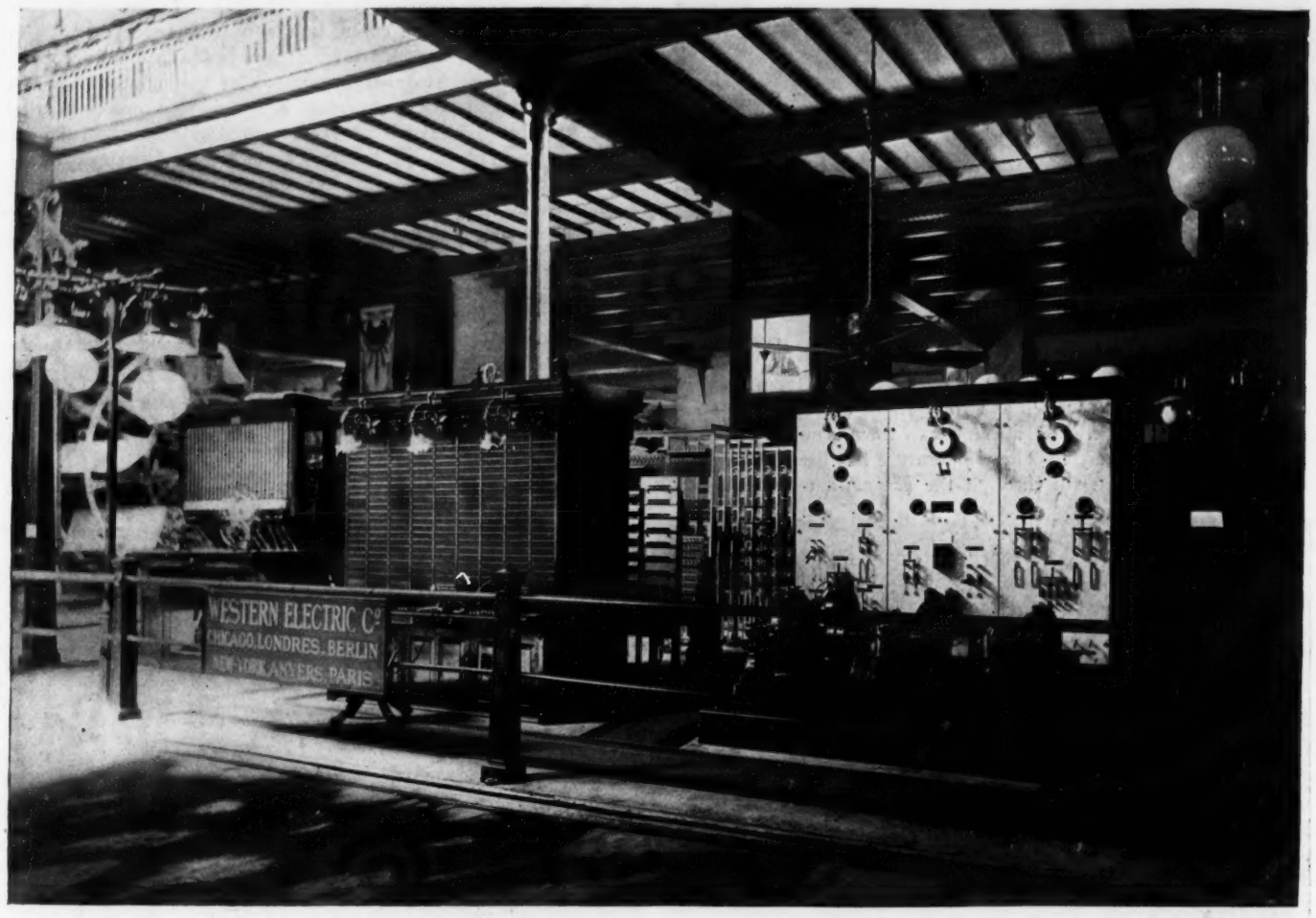


FIG. 1.—EXHIBIT OF THE WESTERN ELECTRIC COMPANY, ELECTRICITY BUILDING.

Power motors are shown, of the three types manufactured by the Western Electric Company, viz.: The open type, the semi-encased and the encased. The encased motors have mica windows over the brushes, permitting one to observe the operation of the latter while the machines are running. These same motors may be operated in a horizontal, vertical or an inverted position, thus permitting users to attach them to ceiling, floor or wall. The encased motor is shown with a back gear attachment, which can be furnished with all motors of this type, if required.

Enclosed arc lamps are shown for use on various circuits, viz.: To run singly on 110 volts, to run two in series on 220-volt circuits and to run on alternating circuits. Of the second type, 48 were furnished to

the United States Commission to light up the United States sections in Groups IV. and V. (electricity and machinery).

Two finished armatures with commutators are shown at the stand, one being that of an arc dynamo furnishing current for 150 9.6 ampere lamps, and the other one an ironclad constant potential armature with spiral end connectors.

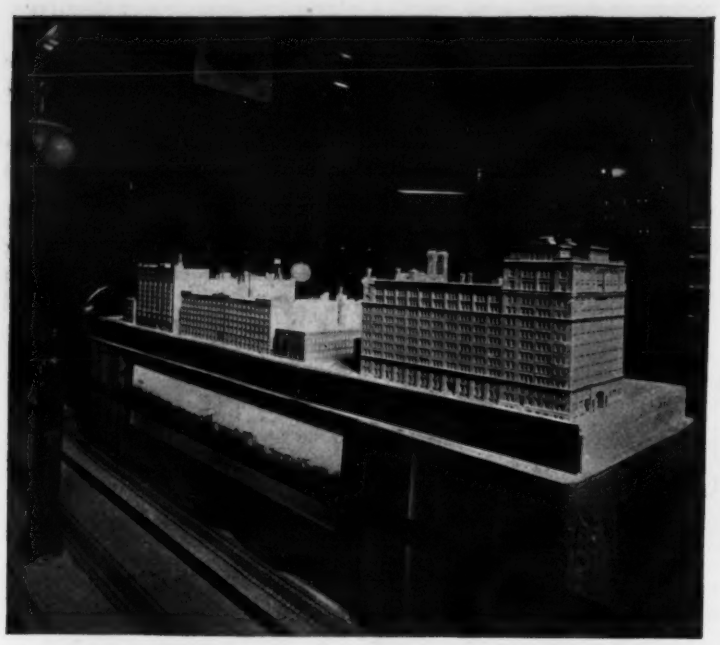


FIG. 2.—MODELS OF WESTERN ELECTRIC COMPANY'S CHICAGO AND NEW YORK WORKS.

Fan motors are shown of both the desk and bracket types, for circuits of 110 and 220 volts, as well as two styles of ceiling fans. These fans are constantly in operation, a number of them sending their cool breezes across the main aisle. The temperature has been rather high in Paris of late, and a walk through the Exposition buildings engenders considerable perspiration and fatigue. Most of the passers-by find it, therefore, very comfortable to repose a moment in front of these fans to cool off a little. Besides, the electric fan motor is more of a novelty here than it is in the United States.

There are also shown plaster models of the factories of the company, located at Chicago and New York. Unlike the majority of large modern manufacturing establishments, these plants are located in the centres of large cities, and are, therefore, of more than the usual height of factory buildings. The number of employees at the Chicago works was 5180 on May 31, 1900, and at the New York works the number was 3788 on the same date. A large framed photograph shows a view of the New York factory, and the surrounding part of the city, taken from Hoboken. Another photograph shows the power plant in the New York factory.

The company has at the space catalogues describing its direct-connected and belted dynamos, slow speed motors, small power motors, direct-current constant-potential arc lamps, direct-current series arc lamps, alternating arc lamps and accessories for arc lighting in English, French, German and Spanish.

Mr. J. M. Hollister is the company's representative in charge. He is assisted by a number of employees attending to the telephone exchange and to the other exhibits in operation. The firm representing the Western Electric Company in Paris—Aboilard & Cie—has a special exhibit in the gallery, near the French Court of Honor, and almost directly above the exhibit just described. It is largely devoted to a superb exhibition of telephone cables and switchboards, all built at the large Paris factory, where Mr. F. R. Welles, so well known throughout the world in connection with Western Electric interests, has his managerial headquarters. There is also a fine Western Electric exhibit in the Austrian section, under the name of the concern making the apparatus in Austria. When it is remembered that the same American concern is also represented by offices and factories in Antwerp, London, etc., pride may well be felt by Americans in this development of a great and growing electrical industry owing its origin to initiative from the western shores of the Atlantic, and still expanding at a rate unequaled at any previous period of its history.

The Exhibits of the Bullock Electric Manufacturing Company and the Lorain Steel Company.

The Bullock Company, of Cincinnati, Ohio, and the Lorain Steel Company, of Johnstown, Pa., have a joint exhibit at the Paris Exposition, which is located on the ground floor of Electricity Building on the Champ de Mars.

This exhibit is the most important in the American section, devoted exclusively to electrical machinery, and all the latest advances in the manufacture of dynamos and motors are there to be seen. It includes street-railway motors and stationary motors, the latter both of the open and enclosed types; also several direct-connected generating units for small installations, and for marine purposes; belt-driven generators, motor starters, street-railway controllers, rheo-

BULLOCK ELECTRIC MFG. CO.'S EXHIBIT.

EXHIBIT OF THE LORAIN STEEL COMPANY.

stats, street-car trucks, double bogie trucks, etc. In addition to the machinery exhibited, there are easels, with cloth-lined panels, on which are mounted the parts of Bullock motors and dynamos, such as armature disks, commutator segments, bearing sleeves, field spools and coils, armature coils, commutators, etc., and nickeled sections of steel rails, manufactured by the Lorain Steel Company. Other easels carry photographs of the new Bullock works and of its products. The latter easels, three in number, contain respectively; one, six illustrations of the various types of motors made by the Bullock Company; one, nine photographs of motors and generators, finished and in construction, including an 800-kw railway and power generator, and one showing nine views of the new shops of the company at Cincinnati, in which electrically-driven machine tools are used throughout—a good representative of the most modern type of American machine shops.

The three direct-connected sets, alluded to above, consist each of a Forbes & Company (Hoboken) vertical engine and a slow-speed, multipolar Bullock generator. The largest of these sets has an engine of 9 ins. x 7½ ins. cylinder dimensions, run at a speed of 375 r. p. m. The generator has an output of 167 amperes at 120 volts. It has its brush-supporting ring held by grooved rollers on pins fastened to the field frame, so that the outboard bearing can be withdrawn without disturbing the brushes. The engine of the second set has a cylinder 7 ins. x 6 ins., and runs at a speed of 500 r. p. m. The dynamo furnishes 80 amperes at 150 volts. The smallest set has an engine with a 4¼ in. x 4 in. cylinder, and has a capacity of 45 amperes at 115 volts, the angular speed being 800 r. p. m. The engines and generators are mounted on the same sub-base, and they are very economical in the floor space required.

The largest machine shown by the Bullock Company is a standard 75-kw, 241-volt, compound-wound generator, the speed of which is 830 r. p. m. From this, the machines get gradually smaller, the next in size being a 50-hp, 240-volt, enclosed steel motor, of a speed of 625 r. p. m. The exhibit contains also a 25-hp, back-geared steel crane motor, and an open 20-hp motor. The machines are all highly finished, and are arranged in a perspective or telescopic manner, which makes an ensemble of attractive appearance, as is well shown by our illustration.

On the side towards the trucks of the Lorain Steel Company are placed a number of their 50-hp street-car motors and "Type 47" Lorain Steel Company's controllers. A peculiarity of the motor construction is that the armature leads are not soldered to the commutator bars, but simply pressed into the slots of these bars, a fact with which the jury is said to have been much impressed. The Lorain Steel Company exhibits, besides the collection of rail sections, already referred to, one Dupont street-car truck with two 25-hp motors, and one Dupont truck, for double-truck cars, with 50-hp motors. A number of street-car rheostats, controllers and trolley poles complete the exhibit.

As is the case with most of the larger American electric manufacturing firms, the Bullock Company has other machines at the Exposition than those shown at its stand in Electricity Building. The large generator furnishing the power for the American Machinery Building at Vincennes is of Bullock make, as are a number of the motors used for driving the machinery there, and in the United States section in Electricity Building. They have already been referred to and illustrated in these pages.

Both the Bullock Company and the Lorain Steel Company are well represented in Europe, their general agents for the continent being "Electra," a firm having its head offices in Paris, and its general offices and storerooms in Brussels. Other European agents for the Bullock Company are Bergtheil & Young, London, and Arthur Heimann, Berlin. The Lorain Steel Company is also represented by Arthur Koppel, Berlin, and by the Société de Construction Électrique, Lyons.

The joint exhibit is in charge of Mr. C. Domar-Kouleitzki, a gentleman who is specially fitted for such a position, being able to converse fluently in French, English, German and Russian.

EXPOSITION NOTES.

VINCENNES ANNEX.—The isolation of the Vincennes Annex to the Exposition appears to be keenly felt by exhibitors in that comparatively deserted section, so that it was suggested by one of them to drape the flags with crape on the occasion of the festival of the 14th of July. A delegation was received a few days ago by Mr. Millerand, Minister of Commerce, who, after listening to their complaints, promised to take measures to improve the state of affairs. Some of the requests formulated were that one ticket should admit the bearer to both the main grounds and the Annex, that military concerts should be given to attract the public, and that evening fêtes should be held, with proper illumination of the grounds. It will doubtless seem strange to many people that regulations of such primary importance and self-evident necessity should have to be suggested to the exposition authorities, who have had plenty of time to act on their own initiative. The arrangements now decided upon provide for the posting of placards throughout the Champ de Mars and Invalides, instructing the public as to the best means of reaching the Annex. The tramways, omnibuses and river boats will also have notices to indicate when they are engaged in Exposition service. Various attractions are promised at Vincennes, such as night fêtes, with fireworks, and military concerts; also the use by cyclists of the racing path when not required for sports. A special service of river boats has been organized, plying between Champ de Mars and Vincennes, with only a few stops on the way, this forming one of the pleasantest means of transit between the two sections. The use of a single ticket for the double entrance has, however, not yet been allowed. As prices are going now, this is no hardship, for tickets are selling for 5 and 6 cents each, with no prospect of any material advance in value.

AMONG THE VISITORS to the ELECTRICAL WORLD AND ENGINEER at the Exposition has been Mr. John T. McRoy, manufacturer of the conduit which bears his name, who was interested in seeing what other countries are doing in that line. For Exposition work, cables were laid directly on the ground, in trenches, much to the detriment of the insulation, which suffered considerable damage from the workmen's feet. Mr. Albert F. Ganz, Assistant Professor of Applied Electricity at the Stevens Institute, Hoboken, has come to Paris to study the latest developments in electrical engineering for the benefit of his students. We have also received visits from Mr. Chas. W. Pendell, of Cleburn, Texas; Mr. Wallace Belmont, of Philadelphia; Mr. R. G. Brown, of Brooklyn; Mr. W. D. Brown, of New York, connected with the Westinghouse Co., and Mr. Otto Volkmann, of New York.

MR. R. A. L. SNYDER, of Pittsburg, visited the ELECTRICAL WORLD AND ENGINEER headquarters a few days ago. He was formerly connected with the Westinghouse Company, and assisted in the erection and testing of the first Niagara generators put in by that company. He is now in Paris, looking up the mica business, as he is the owner of a special system for preparing mica for electrical purposes; incidentally he is studying the latest developments in electrical machinery.

DR. J. T. M. JOHNSTON, of St. Louis, one of the United States commissioners to the coming Exposition of St. Louis, is in Paris, and a frequent visitor to the present Exposition, which, in view of his participation in the proposed American show, is full of interest. Dr. Johnston will doubtless study all the good features to be found here, and will take note of the bad ones to be avoided, so that the ultimate success of the St. Louis Exposition will be further assured by his visit to this city.

MR. WILLIAM J. HAMMER has come to Paris for a stay of some two months, this period covering the electrical congress, when prominent electrical engineers of the world will be here.

MR. GEORGE STEPHENS, electrical engineer for the French Thomson-Houston Company, paid the ELECTRICAL WORLD AND ENGINEER a visit recently. He was connected with the old Thomson-Houston Company, of Lynn, some ten years ago, but has since made his home in Paris, a city which he thinks grows upon one. The majority of American engineers having relations with the Exposition have unpleasant memories of the place; but Mr. Stephens's experience leaves room for hope of better impressions if the show were to be continued a year or two in its completed state, because by degrees one would get to know in which particular isolated section to search for any desired exhibit.

DIRECTOR DRAKE, of the Machinery and Electricity Department, United States section, has gone to Switzerland for a short rest, which is well earned, as he has been for several months hard at work with the innumerable duties of his important department, and is still preserving, through all his trials with dissatisfied exhibitors, incompetent workmen and red-tape officials, the same quietness of manner and thorough grasp of the situation that has always characterized his work, and has made his section one of the most advanced and best organized of any in the Exposition.

BULLOCK.—The representative of the Bullock Electric Mfg. Company, of Cincinnati, Ohio, Mr. C. Domar-Kouleitzki, reports the business outlook as good. He has undertaken to guide through the Exposition a number of students from the universities of St. Petersburg and Moscow, who are expected in Paris within a few days.

Development of the Radiophone.

At the Electrical Exhibition in New York City last year a very interesting demonstration was given of the use of the arc light in conjunction with the telephone for conveying sound to a distance along a beam of light. This radiophone was worked across Madison Square Garden, the transmitter being in the northwestern gallery and the receiver on the other side of the hall. A patent has now been issued on the improvements then shown, to Mr. Hammond V. Hayes and Mr. E. R. Cram, and has been assigned by them to the American Bell Telephone Company. It was in the Patent Office for three years. The principle is shown in the accompanying text and cuts.

The simplest form of transmitter is shown in Fig. 1. *G* is a generator of the electric current; *E* is the arc of an arc light in circuit with the generator by wires *w w*, as shown; w^2 is a shunt-circuit containing a microphone-transmitter *M*, and *R* is a parabolic reflector.

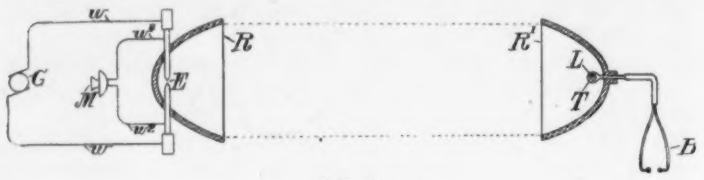


FIG. 1.

In the radiophone-receiver, shown in Fig. 1, *R'* is a parabolic reflector. *L* is a substance extermely sensitive to heat, such as burnt cork or lampblack, and *T* is a glass tube containing the sensitive substance *L*, closed at the end within the reflector and open at the other end. For convenience a flexible tube *B*, provided with earpieces, is employed, as in the phonograph. The energy of the electric current from *G* is converted into radiant energy in the arc *E*, and is modified by the microphone-transmitter *M* when the latter is spoken to in the ordinary manner—that is, by shunting a portion of the electric current from the source of the resonant energy and thereby varying the radiant energy. The parabolic reflector *R* faithfully reflects in parallel lines the rays of energy in all their changing conditions, due to the action of the microphone in the shunt-circuit, and these rays in every condition are received by the parabolic reflector *R'* and focused upon the sensitive substance or lampblack *L*, which will now emit articulate sounds corresponding to the changes produced in the microphone *M* by talking to it in the ordinary manner.

Again, in Fig. 2, *G* is an electric generator. *E* is the source of radiant energy, being in this instance an incandescent light in circuit with the said generator by wires *w w*. *G'* is an auxiliary generator furnishing an alternating current in a shunt-circuit w^2, containing also a Morse key *K* and a condenser *C*, and *R* is a parabolic reflector. When the key *K* is depressed, the condenser *C* permits the alternating current of the shunt-circuit to pass through the source of radiant energy, but prevents the direct current of the main circuit from passing into the shunt-circuit. In this instance the desired variations in the radiant energy are effected by superimposing a variable current upon the direct current at the source of the radiant energy. With this radiophone-transmitter either form of radiophone-receiver may be used.

In Fig. 3, *G* is once more the generator. *E* is an arc light in circuit with the generator by wires *w w*. *C* is a condenser in a shunt-circuit w^2, which contains also the secondary *s* of an induction-coil

FIG. 2.

w^3 is a second shunt or branch circuit from the main circuit provided with two equal resistances *r r* and connected in turn, as shown, with a shunt from itself (circuit w^4). This last-named shunt-circuit w^4 contains the primary *p* of the induction-coil, already mentioned, a Planté cell *N*, placed equidistant from the said two resistances *r r*, and a microphone-transmitter *M*. The operation is obvious with either form of radiophone-receiver. In this instance also a variable current is superimposed upon the direct current at the source of radiant energy.

In Fig. 4, *E* is an electric light, and *w w* the main circuit containing both, as before described; but in this instance upon the field-magnets of the generator *G* are wound convolutions of wire *e*, included in an auxiliary circuit w^5, and having only inductive association with the main circuit, in which is in turn included an auxiliary source of current, in this instance a battery *Y* and a microphone-transmitter *M*. Here the variations in the auxiliary circuit increase

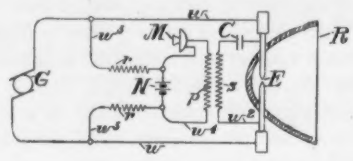


FIG. 3.

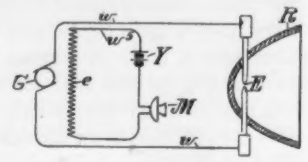


FIG. 4.

and decrease the strength of the magnetic field of the generator. Thus, the desired variations in the radiant energy developed at *E* are produced by varying the intensity of the direct current.

The inventors state that, although they can use the incandescent lamp, the arc lamp is actually essential for practical work in "wireless telephony" of this class.

CURRENT NEWS AND NOTES.

THE TELEPHONE AND POOL ROOMS.—A gang of sharpers have recently succeeded in taking about $100,000 from the various pool rooms in New York City, by means of the use of long distance telephones. The telephone, being quicker than the telegraph, they were able to bet on a horse that had already won in St. Louis or Chicago.

A NEW ATLANTIC CABLE ROUTE.—The Commercial Cable Company announces the successful laying of its new cable between New York and the Azores Islands. This cable connects with the systems of the Eastern and Western Telegraph companies for Portugal, Spain, the Mediterranean ports, Africa, Asia, Australia and South America.

GERMAN AZORES CABLE.—The German cable from Coney Island to the Azores will be laid during August by the cable steamer Anglia, which is now on her way to New York. The work will take several weeks. The cable between the Azores and Emden, which is the German landing point, was finished early in July, and is in operation. The entire cable is expected to be ready for service in the middle of September. The American end of the new cable will be operated by the Commercial Cable Company, and the European end by the German telegraph administration. Bruno Koehler, Privy Councilor in the German Post Department, who arrived here some days ago, will be on board the Anglia to witness the laying of the cable. The owner of the new cable is the German Atlantic Company, a private corporation of Cologne.

NEW THERMOSTAT ALARM.—Mr. Henry Guy Carleton, whose ingenious "pansignal" system was recently illustrated and described in these pages, has now had issued to him a broad patent on an ingenious thermostat, adapted to a sudden thermal change in either direction. Several forms are shown, but they each include two coacting hermetically closed chambers or bulbs of unequal thermal sensitiveness containing a gaseous substance and so connected that the pressures therein will be opposed, so that during gradual or normal changes in temperature, both bulbs or chambers are affected thereby substantially to the same extent, and the opposing pressures in both maintained substantially equal, but on a sudden and substantial thermal change the bulb or chamber of greater sensitiveness is first affected, so as to cause a difference in the relative pressures in the two bulbs or chambers and a corresponding movement relatively to the terminals of the circuit in which the thermostat is located of a displaceable circuit-closer carried by or connected to the thermostat. The circuit-closer of the present case preferably will be located in the interior of the thermostat, so as to be displaced directly by the excess of pressure in one bulb or chamber over that in the other; but it may be connected to the thermostat in such a way as to be displaced on a rocking or other bodily movement of the latter. It is immaterial what gaseous substance is employed in the chambers or bulbs. It may be a permanently gaseous substance or be formed by the volatilization of volatile substances of low boiling point, and may consist of

carbon dioxid, sulphuric ether, air, or any other gaseous substances or mixtures thereof. It is also immaterial what the character of the displaceable circuit-closer carried by or connected to the thermostat may be; but it will preferably be mercury, though other fluids—as sulphuric acid or a solution of mineral salts, etc.—may be employed. Where, however, mercury is employed as the circuit-closer and it is located in the thermostat so as to contact with the gaseous substance in the bulbs or chambers, the gaseous substance employed in the chambers s carbon dioxid, which will not oxidize the mer cury.

A NEW CAR CONTROLLER has been patented by F. A. Merrick and E. W. Stull and assigned to the Lorain Steel Company. It is chiefly designed for cars with four motors, so that they may be started from a position of rest in which all their elements are connected in series and changed over to a multiple position in which pairs of the motors are connected in multiple and the multiple pairs in series with each other through a series of intermediate circuit changes of suitable character to accelerate the motors without injury to their coils or brushes. By handling the motors in this manner they are able to get a maximum effect of torque, particularly in starting from a position of rest, and can use a higher potential on the line with less drop in potential along the line. A further object is to provide a brake-controlling switch for connecting the motors in a closed circuit independent of the line and in a manner whereby their braking action when running as generators driven by the momentum of the car may be effectively utilized; also, to provide means whereby said switch cannot be operated until the motors have been disconnected from the line-circuit, thereby preventing injury to the motors by reason of any movement of the brake switch tending to cause them to act as generators while they are still receiving current from the line; also, to provide means whereby the motors cannot be connected with the line except when the brake switch is at the "off" position, so that as long as the motors are connected to run as generators no current can be made to pass to them from the line. The invention consists first in the combination, with four electric motors, of a pair of controller-drums intergeared one with the other, so that they may be simultaneously operated by the movement of a simple handle-lever, each drum having contacts and connections for changing from series to parallel one pair of the motors through a series of intermediate steps in which the strength of the fields and the ohmic resistance of the circuits are gradually changed to gradually accelerate the motors, the two drums being electrically connected in series. The invention also consists in a brake-controlling switch having contacts, brushes, and proper electrical connections whereby the motors may be connected to operate as generators and the ohmic resistance of the motor-generator circuit may be reduced as the speed of the armatures decreases; also, in the provision of contacts carried by the brake-controlling switch and controlling the passage of current from line to the motors; also, in the provision of an electromagnetic locking device for the brake switch, whereby it cannot be operated until the current is cut off from the motors. In connection with the apparatus Messrs. Merrick and Stull employ artificial resistance for the rheostatic control of the motors in starting from a position of rest and for using in the braking-circuit, and a combined reversing and cut-out switch having certain novel features.

ELECTRIC STEERING GEAR.—A patent to H. W. Buck on electric steering gear has been assigned to the General Electric Company. Mr. Buck uses a constantly running motor, smaller than those hitherto used for such work, as it has full speed torque and only takes a current limited by its high speed, maintained directly in circuit across the ship mains at full voltage and without ohmic resistance. The motor is connected to the body to be moved through the medium of electromagnetic clutches positioned one at each end of a counter-shaft connected to the rudder through suitable gearing. These clutches are oppositely geared at the two ends of the counter-shaft, and it is designed to have only one of them in operation at a given time. By this arrangement when one clutch is engaged the counter-shaft rotates clockwise. When the other is engaged, it rotates counter-clockwise. This counter-shaft drives the rudder through a worm-gear or some other non-reversible gearing, so designed that the friction loss is great enough to hold the rudder in any position in which it may be left. A series of contacts in the pilot house connect by wires with other contacts located adjacent to the rudder and the connection of which is controlled by the motion of the rudder or other driven part. The relation of these sets of contacts is such that as the wheel is moved certain circuits are completed through the electromagnetic clutches, and as the rudder moves these circuits are modified until they are all opened and the clutch is thrown out of action. Inasmuch as the clutch may at all times require considerable current to hold it securely, Mr. Buck "relays" its operation, and in addition to the contacts provides a switch connected to the wheel, which controls the connections of two electrically actuated devices which constitute relay-switches, one for each of the electromagnetic clutches. When one of these is closed, one clutch receives current, and when the other is closed the other clutch is energized. Of course, the connections are so arranged that only one relay may act at a time. With the arrangement of apparatus thus described, it is of importance to prevent the clutches sticking after they should be released by the motion of the rudder as it opens the relay-circuit. To this end the inventor exposes the metal of each clutch to a constant magnetomotive force opposed to the magnetomotive force produced by the energizing-coils by providing in each clutch a differential coil acting against the main coil and so adjusted, as above described, that it provides a differential effect sufficient to overcome remanent magnetism. Thus, as soon as the circuit of the clutch is opened the current passing in the differential coil brings the magnetomotive force of the clutch to zero. It is then entirely released. In many cases it is important, especially on shipboard, to prevent sparking. This is more particularly liable to occur at the relay-contacts, which are, therefore, bridged by a condenser, which takes up or opposes the extra current on opening the relay, largely due to the inductive winding of the clutch.

COMBINATION MOTOR CYCLE.—A self-contained automobile, not dependent on power plants, has been the aim of many inventors, and a patent on one has now been issued to J. H. Munson, of Chicago. In his automobile the explosion-engine and the motor-dynamo are of about equal power, the engine being capable of alone propelling the vehicle over ordinary roads and furnishing a surplus power, which is taken up in driving the motor-dynamo to maintain the voltage of the storage battery. Although it is possible to run the engine for the sole purpose of storing the batteries when they are first placed on the vehicle, the batteries are usually charged before they are placed in the compartment or box. Thereafter when it is desired to use the vehicle charging-switches throw the motor-field into series with the armature, so that the machine will operate as a motor when the controller is operated to close the battery-circuit. The motor being started, the engine-clutch is then moved to connect the engine crank-shaft and the armature-shaft to operate the engine-piston and draw in the first few charges of gas until the engine begins to work automatically. Meantime, one or the other of the friction-pulleys provided having been shifted into engagement with the opposite one on the armature-shaft, the vehicle will be set into motion. The motor alone is capable of starting the vehicle; but when a difficult start is to be made it is preferable to allow the engine and the motor to gather the normal speed before the friction-pulleys are thrown in to start the vehicle. If a fairly good road is encountered. the controller switch-lever may be thrown to the middle position to open the battery-circuit, the engine alone being used. On an ordinary road the charging-switches may then be thrown to connect the dynamo-windings in circuit and the controller will be moved to arrange the batteries in parallel, so that as the vehicle moves along the road the surplus power of the engine will be stored electrically in the batteries. When passing over rough roads or when climbing hills, the switches will be reinstated to connect the motor-windings in circuit. The electric machine thereafter works as a motor to assist the engine, and the speed of both the engine and the motor is controlled by the electric controller, which in regulating the speed of the motor-armature also regulates or governs the speed of the explosion-engine, of which said armature is the flywheel. When it is desired to force the vehicle at a higher speed than can be attained with the explosion engine running at the maximum number of revolutions, the engine-clutch will be disconnected and the motor alone relied upon, the controller being shifted to supply current from the batteries at a higher voltage, whereby the speed of the motor will be increased and the current taken from the battery being commensurate with the work to be performed at the higher speed induced by the increased voltage. When the engine is disconnected from the armature-shaft, it will instantly stop owing to the same being deprived of its flywheel. In addition to the control of the speed through the medium of the motor two arbitrary changes of speed are possible through the use of the friction-pulleys. This patent was applied for in May, 1898.

CHICAGO STREET CARS.—The forthcoming report of the Municipal Street Railway Commission is practically certain to contain a recommendation that the present downtown terminal loops of the surface street car companies be abolished and a system of through service adopted which will enable passengers to go through the heart of the city from one division to another without the payment of two fares. Having established legal municipal ownership of the tracks, legal advisers maintain that the next logical step is to license the street car companies under the general licensing law for the operation of vehicles. Under this plan the city can maintain absolute supervision over the question of fares to be charged, the character of the service, the number and frequency of the cars, etc.

CABLE TO PORTUGAL.—Congratulatory messages between President McKinley and the King of Portugal were flashed direct last week over the new line of the Commercial Cable Company, which has just been put in operation between the Azores and this country. Felicitations were also exchanged between the President and American residents in the Azores, as well as messages from the American officials of the company and the local authorities at the Azores. The new cable, as shown some months ago in the ELECTRICAL WORLD AND ENGINEER, connects at the Island of Fayal with the Europe and Azores Company's line from the Azores to Portugal, and is the first to connect the Azores with the United States. It also opens direct communication for the first time between this country and Portugal. The Europe and Azores Company's cable makes connection at Lisbon with the Portuguese land lines, the Eastern Telegraph Company's cables to Spain, the Mediterranean ports, all Africa, India, China, Japan, Australia, and the Philippines, and with the Western Telegraph Company's cables to Brazil, Argentina, and other parts of South America.

LETTERS TO THE EDITORS.

Recording Telephones.

To the Editors of Electrical World and Engineer:

Sirs:—There is practically no demand for a recording attachment to telephones, and, if one was needed, the method of engraving into wax is the simplest and occupies the least space for a given length of a sound record.

I tried the Poulsen system in 1879, using a knife blade which formed the pole of a sensitive electromagnetic receiver, and which was in contact with a moving steel ribbon. The results were not promising for a practicable device, neither was an experiment in which a steel piano wire passed through a perforated pole-piece which I also tried.

E. BERLINER.

WASHINGTON, D. C.

Shunting Thomson Recording Wattmeters.

To the Editors of Electrical World and Engineer:

Sirs: I have noticed with some little surprise that the editorial in your issue of June 23, on the subject of shunting Thomson Recording Wattmeters, has not been followed by any discussion of the subject.

I should like to call attention to several features which seem to me a prohibition of such practice, however desirable it may be for reasons of convenience.

Taking up first the question of modification of design of the astatic meter, it is evident that any increase in the space occupied by the main conductor would be at the expense of further separating the two armatures and a consequent sacrifice of astaticism.

An increase in the ampere turns of the armature would magnify the effect of local fields, and maintaining the same meter torque (a necessary feature), the ratio of local field to true meter field becomes greater, and the error introduced increases accordingly.

Taken with the increased distance between the armatures, the errors due to local fields—so common on compact switchboards—become prohibitive.

The total field ampere turns of the average size meter (50 to 600 amperes) are 1800, a small value when compared to the 5000 or 10,000 of the astatic station type. This weaker field shows the undesirability of using the standard meter with a shunt even if we neglect the enormous advantage of an astatic arrangement.

Taking for example a 50 ampere meter; in order to increase its capacity to 16,000, the current of the isolated plant mentioned would require an expenditure of nearly six kilowatts in the shunt.

The alternative is to shunt a portion of the existing bus-bar.

Let O = Ohms per 1000 ft.
Y = Specific resistance of meter leads.
K = A constant.
M = Resistance of meter field.
L = Resistance of meter leads.
R = Resistance of portion of bus-bar shunted.
C = Total current.
S = Rated current capacity of meter.
V = Length of meter leads (in feet).
W = Specific resistance of bus-bar.
Z = Length of bus-bar shunted (in feet).
A = Cross section of bus-bar, square inches.
B = Cross section meter leads, circular mils.
F = Cross section meter leads, square inches.
G = Ampere per square inch of shunted bus-bar.
H = Ampere per square inch of meter lead.

By definition of specific resistance, a wire of one square centimetre cross section has a resistance of Y micro ohms per centimetre length. Therefore, the resistance in ohms per 1000 ft. of this wire must be

$$\frac{2.54 \times 12000\ Y}{1{,}000{,}000} = .03048\ Y \ldots\ldots\ldots\ldots\ldots (1)$$

Since the resistance of a given length of conductor varies directly with the specific resistance and inversely as the cross section

$$O = \frac{K\ Y}{\text{Cross Section}}$$

If the cross section of conductor is given in square centimetres, we have from equation (1)

$$K = .03048 \qquad O = \frac{.03048}{\text{Sq. CM}}\ Y \ldots\ldots\ldots (2)$$

If the cross section is given in square inches, this becomes

$$K = \frac{.03048}{6.4514} \qquad O = \frac{.0047245}{\text{Sq. In.}}\ Y \ldots\ldots\ldots (3)$$

If the cross section is given in circular mils

$$K = \frac{.03048 \times 1000000}{6.4514 \times .7854} \qquad O = \frac{6015.4}{\text{Circ. Mils}}\ Y \ldots (4)$$

In shunting a bus-bar by a meter, it is necessary—in order that the meter may receive its rated current when the bus-bar has normal current—that the fall of potential across the shunted portion of the bus shall be

$$R(C - S) = S(M + L)$$

But from (4)

$$L = \frac{6015.4\ Y}{1000\ B}\ V$$

and from (3)

$$R = \frac{.0047245\ W}{1000\ A}\ Z$$

and therefore

$$\frac{.0047245\ WZ\ (C - S)}{1000\ A} = S\left(M + \frac{6015.4\ YV}{1000\ B}\right) \ldots\ldots (5)$$

or

$$Z = 211663\,\frac{A\ S(M\ B - 6.0154\ V\ Y)}{W\ B\ (C - S)} \ldots\ldots\ldots\ldots (6)$$

which is the general form of equation if bus-bar cross section is given in square inches and lead cross section in circular mils. This expression may be reduced to a more convenient form by assuming, as will almost invariably be true, that the specific resistance of the bus-bar and of the leads are the same, and that the length of lead is the same as length of bus shunted. Under these conditions

$$Z = \frac{1000\ S\ M}{W\left(.0017245\,\frac{C - S}{A} - 6015.4\,\frac{S}{B}\right)}$$

$$Z = 211663\,\frac{S\ M}{\frac{C - S}{A} - \frac{S}{F}} \ldots\ldots\ldots\ldots\ldots\ldots (7)$$

or

$$Z = 211663\,\frac{S\ M}{G - H} \ldots\ldots\ldots\ldots\ldots (8)$$

This equation can have a finite value only when H is less than G; that is, it is impossible to obtain as great a current density in the meter leads as in the bus. A self-evident truth.

Turning once more to the isolated plant, the current density in the bus-bar is 800 amperes per square inch, and as the current density in the meter lead must be less than this, the current in the meter using a No. 0 wire for meter lead must be less than

$$.082932 \times 800 = 66 \text{ amperes}$$

The nearest standard size is a 50 ampere meter with a field resistance of .00732 ohms and substituting in equation (7)

$$Z = 211663 \frac{50 \times .00732}{\frac{16000 - 50}{20} - \frac{50}{.082932}} = 398 \text{ ft.}$$

This length of bus-bar is, of course, not available, and a shorter length would be insufficient.

For those installations where sufficient bus length is available, we have to consider the errors introduced.

In order to avoid errors, it is necessary to keep the meter field, meter leads, and portion of bus shunted at the same temperature. The draft from an open window may cause an error of 5 or 6 per cent, and whether the tendency is to over-record or under-record, depends on the portion of the divided circuit subjected to the draft. Proximity of steam pipes will also introduce errors and, in general, anything tending to heat or cool any portion of either branch of the divided circuit will introduce errors of greater or less magnitude.

More than this, a variation of current will, of itself, cause a difference in heating of the different portions of the circuit, as the radiating surfaces per watt loss can not be even approximately equal, and the coefficients of emissivity are widely different. This will result in considerable differences of temperature and each degree centigrade variation will cause a variation of four-tenths of a per cent in the registration of the meter. As an illustration of possible errors from this source, I may say that I have known an ammeter with copper coefficient shunted by a 1000 ampere copper bus to vary between 15 and 20 per cent, due to errors caused by heating effects of the current, and in no case did the current density exceed 1000 amperes per square inch.

These errors are all based on the constants of standard Thomson Recording Wattmeters, and it must be remembered that while the magnets of a high capacity meter are protected from local fields by a magnetic shell, and in some cases by a double magnetic shell, that the magnets of the standard low-capacity meter are unprotected, and when used in proximity to buses carrying such enormous currents, could not be expected to remain constant.

Summing up these objections to shunt meters, we have

1st, Excessive length of bus necessary.
2nd, Errors due to changes of temperatures.
3rd, Errors due to change of current itself.
4th, Errors due to local influence on magnets.
5th, Errors due to local influence on armatures.
6th, Errors due to variation in contact resistances.

These results show why the Thomson Recording Wattmeters have not been shunted in the past, and also indicate that it is not a practice which is liable to be followed in the future; at least, not until we are able to obtain a metal for use in bus-bars which will have the conductivity of copper with zero temperature coefficient; and the practice must be looked upon as wholly impracticable at the present time.

LYNN, MASS. FRANK P. COX.

DIGEST
OF
CURRENT ELECTRICAL LITERATURE.

Temporarily Conducted by E. F. ROEBER, Ph. D.

DYNAMOS, MOTORS AND TRANSFORMERS.

REFERENCES.

Induction Motors.—EBORALL.—The first part of an illustrated reprint in full of the Brit. Inst. Elec. Eng. paper, noticed in the Digest June 16.—Lond. *Elec. Eng.*, July 20.

Weight Economy of Dynamos.—A critical remark by Osnos on a point in Rosenberg's paper (Digest, Apr. 7, May 5), also Rosenberg's reply.—*Zeit. fuer Elek.*, May 27.

Starting Resistances.—A. H.—A description, illustrated by diagrams, of different kinds of resistances for starting and regulating electric motors.—*Elek. Anz.*, May 24.

LIGHTS AND LIGHTING.

Arc Lamp Distribution.—ADAMS.—An article calling attention to the disadvantages of series arc distribution. He says the ideal system of arc lamp operation would be that on which they are supplied from the same system of distribution to which incandescent lamps and motors are attached. A station equipped with high-pressure, alternating-current dynamos may be free from any auxiliary equipment for arc lamp circuits; the same distribution lines to which transformers are attached for service to incandescent lamps and motors are also available for the transformers that supply the arc lamp circuits. He says that a desirable arrangement for street lighting includes as many circuits from the secondary terminals of each transformer as there are separate arc lamps or series of arc lamps to be operated by it; the conductors for each arc lamp or series of arc lamps should be given nearly the resistance necessary for good regulation, and then a small variable resistance connected in each circuit. He says that the 10 or 20 per cent loss of energy that must occur for purposes of regulation in constant pressure lines for arc lamps or in their special resistance coils, is no serious objection, as the increase of efficiency at the generating stations and in the high pressure line do much more than offset this loss.—*Elec. Rev.*, July 25.

Incandescent Lamp.—DE SEGUNDO.—The first part of an article, in which he finds the light equivalent of one thermal unit at 1.5 candle-hours, this being a relative value based upon the chemical combustion of coal gas with oxygen. From this he finds that 60 watt-hours should yield 307 candle-hours, so that the efficiency of the 60-watt 16-cp lamp becomes 5.2 per cent. There should, therefore, be ample scope for improvement in this direction. He refers briefly to the development of the incandescent lamp, and begins to abstract the paper of Willcox, noticed in the Digest Apr. 14, May 26.—Lond. *Elec. Rev.*, July 20.

Regulating the Illumination of Incandescent Lamps.—A brief, illustrated description of resistances, devised by Hummel and Helberger, to regulate the illumination of incandescent lamps, which is sometimes desirable in hospitals, etc. Upon a china base a ring of soapstone is mounted upon which a spiral resistance is wound, a sliding contact allowing to take off the current, so that the illumination can be varied continuously.—*Elek. Anz.*, June 10.

POWER.

Rival Systems of Electric Power.—An editorial on the relative advantages of direct-current, single-phase and polyphase motors. To the single-phase motor a condenser is said to be almost a necessity of existence; but the condenser, even when perfected, will fall short of raising the single-phase motor to the rank of the ordinary polyphase motor; the single-phase motor is doing good work, in a restricted way; factories are being driven by it, and it has shown itself useful in a variety of cases where other electrical power could not be obtained, but it has not the elasticity and ease of the polyphase system. It is thought that where motor power work alone is to be carried out, or wherever the load is chiefly due to motors, the polyphase systems are superior to any other; but where the load is largely due to electric lighting, practice will probably for some time to come be divided between polyphase and direct current systems, or will consist in a combination of the two.—Lond. *Elec.*, July 20.

Gas Engines for Central Stations.—Some editorial notes referring to a suggestion made by Brown in the recent convention of the Brit. Mun. Elec. Ass'n. He recommended municipalities owning gas works to lay down a network of distributing mains and install a gas engine plant to the extent of about 150 kilowatts as a pioneer undertaking, and, if the demand requires, then to put up a steam generating station. This recommendation was dissented from is the discussion by other speakers, who considered gas engine stations a failure. It is pointed out that it would be wrong to draw general conclusions from special failures, as in every case the want of success arose from contingencies which had a pure local character. It is shown that in many cases, it would pay to lay down gas engines first, and later, when the load has grown large, to replace these with steam plant. The chief recommendation of the gas engine over the steam engine, for small

pioneer work, is the simplicity and comparative insignificance of the experiment.—Lond. *Elec.*, July 20.

REFERENCES.

Three-Phase Current Transmission.—LENNER.—An illustrated paper in which he develops the equations for a power transmission with three-phase currents with star connection. The graphical method is used for treating the problem.—*L'Elettricista*, Apr. 1; the first part of a German translation in full, with illustrations, in *Elek. Neu. Anz.*, June 1.

Calculation of Transmission Lines.—EHNERT.—An article, illustrated by diagrams, in which he shows how to calculate a line for the transmission of a great amount of power over a great distance by means of single-phase alternating current. He first develops the formula for the voltage drop in the line, without considering the capacity and reactance of the line. He then shows how to consider the capacity and reactance, and gives a numerical example.—*Elek. Anz.*, June 17, 21.

Three-Phase Transmission in a Mine.—A. KOLBEN.—An illustrated description of the electric installation of the Humboldt mine, in Bruex, Bohemia, for hauling, driving ventilators, pumping and lighting. Three-phase currents are generated at 2150 volts, the periodicity being 50, and are transformed down to be supplied to the motors and lights. Induction motors are used throughout.—*Zeit. fuer Elek.*, May 27.

Electricity in Collieries.—WALKER.—A well illustrated article on the applications of electricity in the collieries of Great Britain. He describes the use of electricity for drilling holes in the coal or the rock for blasting, and for firing the shots; discusses at some length the electric methods of coal cutting, and deals more briefly with the use of electricity for mine haulage and pumping.—*Eng. Mag.*, August.

Turbo-Alternators in Frankfort.—A note stating that a 4000-hp, single-phase, turbo-alternator has been ordered for the extension of the central station of Frankfort, Germany. The present plant has a capacity of 8000 horse-power. Although a single-phase plant, the total capacity of the motors connected to the mains exceeds 5000 horse-power.—Lond. *Elec. Eng., Elec. Rev.*, July 20.

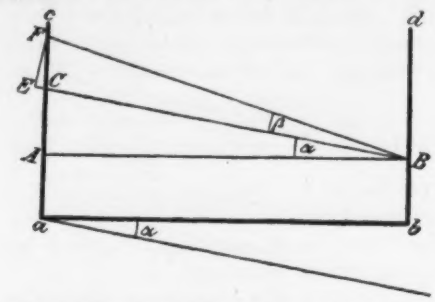
Refuse Destructors.—HIGHFIELD.—A reprint of the English paper on the power plant at St. Helens, abstracted in the Digest July 28.—*El'ty*, July 25.

Electric Cranes.—VOGELSANG.—His paper, noticed in the Digest June 9, on the moving mechanism of electric cranes, operated by several direct-current motors.—*Elek. Rund.*, June 1, 15.

Electrically-Driven Organs.—A brief, illustrated description of a method, used in a church in Leipzig, Germany, for electrically driving the bellows of the organ.—*Elek. Anz.*, June 21.

TRACTION.

Measuring Instrument for Tramways.—KAPP.—An illustrated paper read before the recent annual meeting of the Union of German Elec. Eng. In a tramway car a tube is placed parallel to the rails; at its ends it is connected to two vertical glass tubes; the tubes are filled with water. If the car is resting on a level road, the points in the two glass tubes, to which the water reaches, may be marked zero. If the car is resting on an inclined plane, the main tube being still parallel to the rails and the two glass tubes at the ends being still perpendicular to the main tube (hence inclined against the vertical direction by an angle which is equal to the inclination of the inclined plane), then in one glass tube the water has risen and in the other it has fallen by the same amount, and the length of fall and rise is proportional to the tangent of the angle of inclination. The glass tubes may be provided with scales showing direct the inclination of the road, while the car rests, the single parts of the scales corresponding to the grades 1 : 1000, 2 : 1000, etc. These scales give then also the component of the gravity parallel to the road; this, however, is not strictly exact, as the component of gravity is proportional to the sine of the angle of inclination, but for the grades found in practice tangent and sine are nearly equal. Therefore, that part of the tractive force, which overcomes the component of gravity, when a car climbs up with uniform speed a hill of uniform grade, may be read direct from the instrument. Let the car now run with varying speed on a horizontal road; the acceleration produces a difference of height of the water in the two glass tubes, and it can be shown by simple mathematics that the scale indicates that part of the tractive force which is required for acceleration. Therefore, in the general case, illustrated in the adjoining figure, that a car is running on an inclined road with varying speed, the instrument indicates at once the tractive force required for climbing up and for acceleration together, in pounds per ton of rolling weight; *a b* is the main tube, *a c* and *b d* are the two glass tubes, the angle x is the inclination of the road. The water reaches to the points *F* and *B*, the difference *A F* of the height of the water gives the whole tractive force required for climbing up the hill and for acceleration



MEASURING INSTRUMENT FOR TRAMWAYS.

together, *A C* is the part due to the inclination, *C F* is the part due to acceleration. He shows that, although the instrument is not strictly accurate, yet the accuracy is sufficient for practice. He describes a practical form of this apparatus which he has used for experiments on Berlin tramways, and makes suggestions for further improvements.—*Elek. Zeit.*, July 12.

Electric Canal Traction in Belgium.—An illustrated description of an electric system of towing canal boats, devised by Gerard, and used on a canal between Brussels and Charleroi, which has a length of 50 miles. Three-phase currents at 6000 volts are generated. The line has two circuits of bare conductors; three primary wires for 6000 volts, and three secondary wires for 600 volts; every three miles there is a 36-kw transformer. By means of a triple trolley the current is supplied to the 5-hp, three-phase motors on the tractors. A leather pinion with 12 or 16 teeth is fixed to the axle of the motor and drives a shaft, on which there is a clutch with which it is possible to drive a chain connected with the driving axle or with a conical winch on the other side; the extra power gained by the use of the winch is of great service at certain times. Each tractor runs only over its own section of ground; it can draw five boats, each laden with 70 tons, at a speed of a little over two and one-half miles an hour. In places where the pathway is too narrow to admit of passing, the tractors simply exchange boats and return on their own road. For passing through towns where the river banks are covered with warehouses, or in going through crowded locks, electric launches are used. The company supplies electricity also for lighting purposes to the villages in the neighborhood.—Lond. *Tramway and R'y World*; reprinted in *El'ty*, Aug. 1.

American Tramway Practice.—LE ROSSIGNOL.—A paper read before the Brit. Mun. Elec. Ass'n, giving "impressions of American tramway practice." He contrasts the conditions in the United States and in Great Britain; in the latter country concessions for tramway construction take a long time to carry through and are difficult to obtain. He discusses the American tendency to absorption of all the competing lines in a city or district by one master company. He says that "municipal ownership in the United States under the conditions prevalent at present in municipal circles at that side, would give rise to a great deal of bribery and corruption, until in course of time a better moral condition of municipal life comes to the front. As economy in current generation is greatly influenced by the expenditure on labor in the station, central station practice in America rightly tends to the introduction of very large steam power units, but these are all of the open slow-moving type, and so require a larger amount of attendance than would the same size units, if enclosed and provided with automatic lubrication, such as have been largely adopted in this country (Great Britain). A system of mechanical oil supply to these large open engines has been adopted, but if the enclosed type were made as strong in proportion and as reliable in operation as the large open type, there is no doubt that increased economy in labor would be obtained, and doubtless English manufacturers will awaken to this fact in a short time." He mentions the successful conduit systems of New York and Washington, refers to the question of the return currents, and says that overhead work in America does not compare at all with what is put up in Great Britain, either as to strength or neatness, but in many other traction matters, the United States is ahead.—Lond. *Elec. Rev., Elec. Eng.*, July 20.

Electric Operation of Trunk Railroads.—A very long summary of the present conditions. An article of Struck is abstracted from *Zeit. des. Ver. deut. Eis. Ver.*, No. 22, 1900. All railways, operated at present by electricity, have the same characteristic features: short length

of line, use of single motor cars without or with very few trailers, numerous stations, cars running in short intervals at low speeds. The present electric railways are, with few exceptions, for urban or suburban service. For trunk railroads the conditions are entirely different: the lines have great length, the trains are long and heavy and running at high speed and at greater intervals, the stations are few. The question of the electric operation of trunk railroads must, therefore, be considered from a different point of view than our present electric street railways. He considers the case that an electric trunk railroad is to be supplied from a steam-driven central station, and says that such a system would be more economical than the present system of steam locomotives only, if it could be shown that the generation of power on steam locomotives is more expensive than the generation of power in a central station, and that the difference in the cost of generation of power is so great that it is more than the extra expenses for the electrical equipment. In the discussion of these points, it is said that the generation of power in steam locomotives is not nearly as expensive as is often supposed. The possibility of obtaining higher speeds with electric than with steam railroads is granted; but it is said that with the steam locomotives the highest possible limit has not yet been reached, so that this point is not of great importance at present. It is said that where at present trunk railroads are operated electrically, there are other conditions similar to suburban service or special conditions, as tunnels, which make the use of electricity desirable, to avoid smoke, etc. He concludes that a general introduction of the electric service on trunk railroads seems at present profitable only, if it would be possible to decrease considerably the weight of storage batteries.—Further a paper of Gerson is abstracted; he discussed the reasons which limit the speed of steam railways and gave a brief summary of different electric systems which have been tried for trunk railways.—Finally a report on the use of motor cars on lines with small traffic by seven railway companies is abstracted from the *Bull. de la Comm. Int. du Congr. des Chem. de Fer,* February. The different types of motor cars used are described: electrically operated are the storage battery motor cars used on some Belgian lines, those on the line from Milano to Monza, in Italy, and those on the French Northern Railway, all of which were already noticed in the Digest.—*Zeit. fuer Elek.,* May 13, 20.

Municipalities and Electric Tramways in Great Britain.—A long article discussing the present conditions in Great Britain. The drawback of the municipal electric tramways is that they are restricted to the area of the municipality, and that there are the greatest difficulties in establishing extensions to the suburbs and to towns in the neighborhood. The London County Council wants to establish a complete system of electric tramways over the entire metropolis; the most serious obstacle arises, however, from the antagonism between the 50 local authorities in London and the County Council. The history of joint municipal schemes is mainly one of failure. Attention is called to the fact that some of the most important tramway schemes in Great Britain could not have been carried out except by private companies.—Lond. *Elec. Rev.,* July 20.

Heavy Motor Vehicles for Road Service.—MAYNARD.—An article in which he shows that a steam-driven heavy automobile is within certain limits the most economical of all systems of freight carriage on land. He says that electric motors are clean, extremely convenient and simple, free from all vibration and danger, and altogether an ideal type of motor; but for freight-carrying wagons to run 40 miles without recharging, electricity appears at the present time impracticable, the great dead weight of the storage batteries being apparently an insuperable difficulty, especially where a fairly heavy useful load is required to be carried; their high cost and short life also militate against their use for heavy vehicle propulsion, as in this service disintegration naturally takes place much more rapidly than in a stationary battery, owing to the vibration over rough roads.—*Eng Mag.,* August.

REFERENCES.

Three-Phase Railways.—An illustrated article on three-phase railways in Switzerland, taken from a report on the trip of the British Inst. of Elec. Eng. to Switzerland, noticed before in the Digest.—*Zeit. fuer Elek.,* May 20.

Electric Locomotives.—A long, illustrated description of electric locomotives of the General Electric Co. of Berlin.—*Der Elec. Tech.,* June 15.

Southampton.—A long, well illustrated description of the municipal electric tramway system of Southampton.—Lond. *Elec. Rev.,* July 20.

Interurban Railway.—An illustrated description of the high-speed electric railway from Toledo to Norwalk, Ohio, 60 miles in length, with three-phase transmission and converter sub-stations.—*Elec. Rev.,* July 25.

Hungarian and Austrian Electric Railways.—A table showing the traffic and the receipts of the electric railways of Hungary in January, February and March, 1900, compared with 1899.—*Zeit. fuer Elek.,* May 13. A table giving the same information for the electric railways of Austria and Bosnia in *Zeit. fuer Elek.,* May 20.

Automobiles.—An anonymous article discussing in a general way the disadvantages of gasoline motors for automobiles. The writer believes that electric automobiles will be the vehicle of the future, but at present the heavy weight of the storage battery is a drawback. He recommends to use gas batteries and to carry liquified oxygen and hydrogen on the automobiles.—*Cosmos,* June 9.

Automobiles.—KOEFINGER.—An illustrated description of some of the electric automobiles at the exposition of automobiles at Vienna. Some remarks are added as to the storage batteries used.—*Elek. Anz.,* July 5.

Automobiles.—ADAMS.—An article on cost and limitation of electric traction. He estimates that the unit of work applied to a vehicle by a horse is 4.2 times as expensive as when the same work is applied by the electric motor. He further compares the nature, arrangement, weight and capacity of electric equipment with horse traction. The electric vehicle has a daily radius of action much greater than that of the horse, and within wide limits is nearly independent of the load for its speed.—*Sc. Amer.,* July 28.

Automobiles.—BAXTER.—An illustrated article of general nature, describing the evolution and present status of the automobile, without special reference to the use of electricity for driving.—*Pop. Sc. Mo.,* August.

INSTALLATIONS. SYSTEMS AND APPLIANCES.

Grounding Certain Portions of Distributing Systems.—WORDINGHAM.—A paper read before the Brit. Munic. Elec. Ass'n on the maintenance of certain portions of distributing systems at earth potential. In high-pressure circuits the reasons of grounding one point are smaller cost of insulation and smaller risk of break-down and greater security to life. In low-tension circuits "the chief object is to enable a consumer to be supplied at such a pressure that no one of the conductors brought into his house will exceed the limit of pressure defined by the Board of Trade to be low pressure." In the case of electric tramways, the one object is to enable the rails to be used as one conductor, chiefly with a view to simplifying the working arrangements, and partly to enable the conductivity of the rails, which must in any case be laid, to be utilized; as the rails are earthed throughout the length of the lines, there is here the danger of stray currents, which point is discussed by him still further. He discusses at some length the question whether it is desirable or not to ground the middle wire of a three-wire system. He says that there can be no doubt whatever that very grave risk of break-down of the insulation of the negative conductors is introduced by earthing the middle conductor; the only consideration that impels one to desire to earth the middle conductor is the fact that it admits of all three conductors being brought into a consumer's premises, thus enabling every installation to be balanced within itself if it be of sufficient size to render it desirable to do so. He thinks that this advantage is sufficient to outweigh the disadvantages, and therefore he is, on the whole, in favor of earthing the middle conductor. He recommends, however, the utmost care in protecting the mains from moisture, and speaks in favor of the "solid system." Further, he recommends, the earth connection should be capable of removal at will; it should, therefore, be at a point easily accessible from the generating station. The discussion which followed the paper is also abstracted.—Lond. *Elec. Eng.,* July 20.

Automatic Replacing Fuse.—A brief, illustrated description of the Hemingway-Coley automatic replacing fuse, designed to provide against the extinction of light frequently caused by a momentary short-circuit. This is done by providing two fuses, the second of which is automatically brought into action by means of a spring when the first has been blown. The assumption is that the interval between the blow of the first fuse and the switching-in of the next is sufficient under ordinary circumstances for the accidental short-circuit to have ceased to exist.—Lond. *Elec. Eng.,* July 20.

Ship Yard.—In the continuation of the account of the proceedings of the recent annual meeting of the Union of German Elec. Eng. a description of the electric installation of the Germania Wharf of the Baltic Electric Co. (Krupp), in Kiel, is given. Direct current is used

for lighting 1200 incandescent and 100 arc lamps and for driving electric motors aggregating about 50 horse-power. For boring large holes in plates, etc., already fixed, portable drilling machines, driven by electric motors, are used. Electrically-driven windlasses and centrifugal pumps are also used. There is also a boat, serving exclusively the requirements of the yards, equipped with 40 storage battery cells of 600 ampere-hours' capacity for five hours' discharge. Considerable extensions of the wharf are projected.—Lond. *Elec. Eng.*, July 20.

Electric Installation of a Print-Cloth Mill.—An illustrated description of the electric installation of the Arnold Print Works, at North Adams, Mass. There is a steam-driven 125-volt, 60-kw, direct-current generator and a battery of 60 chloride storage battery cells for supplying current to 300 incandescent lamps, 40 arc lamps and 5 motors, of capacities between 7½ and 15 horse-power. The service is largely intermittent. The battery is used as a regulator to eliminate the fluctuations from the generator load, also for peak work during certain times of the year when the lighting load becomes very heavy, and also sometimes for all-night lighting. The connections are described.—*Elec. Rev.*, July 25.

Electricity in the German Navy.—An article giving a summary of the development of the use of electricity in the German Navy. While until about 1895 electricity was used there only for lighting, it is now used also for power purposes, for driving the ventilators, turrets, etc. Electric transmission of signals, orders, etc., has come into considerable use in recent years; for this purpose storage batteries are connected in parallel with the generators to supply current in case an accident should occur to the generators. One of the largest electric installations is on the Fuerst Bismarck, where there are five generators, each of 65 kilowatts, the voltage being 110.—*Elek. Anz.*, July 5.

REFERENCES.

Asnieres.—LAFFARGUE.—A brief description of this new French three-phase plant noticed in the Digest Aug. 4.—*La Nature*, June 23.

Buenos Ayres.—A continuation of the article (Digest, Aug. 4), describing the monocyclic generators and the switchboard.—Lond. *Elec. Rev.*, July 20.

Gloucester.—A long, illustrated description of the recently opened direct current plant at Gloucester for supplying public and private lighting. A refuse destructor has been erected in connection with the station.—Lond. *Elec. Eng.*, July 20.

Three-Wire System.—A. H.—A description of different methods of regulating the voltage in a three-wire system.—*Elek. Anz.*, June 7.

Installation of a Factory.—An illustrated description of the electric installation for lighting and power purposes of the chemical works of Schulz, in Leipzig, Germany. Direct current is used for lighting and three-phase current for power purposes; induction motors are used. There is also a storage battery for lighting purposes at light load.—*Elek. Anz.*, July 1.

Danger of Fire.—MAY.—An article discussing the dangerof fire resulting from carelessly made electric light or power installations.—*Elek. Anz.*, June 24; *Der. Elec. Tech.*, June 30.

WIRES, WIRING AND CONDUITS.

Electric Cables in Mines.—VALKER.—An article discussing the difficulties in insulating cables in mines and protecting them against mechanical injuries. He recommends vulcanized india rubber insulation of one-tenth to one-eighth inch thickness; but as this insulation is finally affected by long exposure to moisture, he recommends to cover the cable, thus insulated, by a layer of hemp impregnated with a substance which is impermeable to moisture and does not affect the india rubber, and to shelter this again by bands impregnated in the same way. A cable treated in such a way should be enclosed in a wood case or lead pipe. A concentric cable with a good paper insulation with sufficient thickness of paper covering the outer conductor, the whole being protected by a light armor sheeting, would form a cable of nearly ideal properties for mines.—*Colliery Guardian*; abstracted in *La Nature*, June 30.

REFERENCE.

Telephone Wires.—An article on the manufacture of wire for telephone purposes. The properties of telephone wires are considered under three headings: conductivity, mechanical strength and durability.—*Tel. Mag.*, July.

ELECTRO-PHYSICS AND MAGNETISM.

Adjustable Condensers.—BRIGGS.—An illustrated description of a new form of electrical condenser having a capacity capable of continuous arrangement. He uses a stack of alternate conducting and insulating sheets, the conducting sheets being of an elastic material, so that the capacity of the condenser may be varied at will by simply compressing the system. As conductors, he uses thin sheets of spring brass; to gain the necessary looseness of structure the sheets of brass are curved to conform to the surface of a cylinder of 6 ins. or 8 ins. radius; the curvature given to the sheet brass by the manufacturer in rolling it for shipment will usually be found to answer well. The range in capacity which can be obtained depends upon the curvature, thickness and number of plates; the maximum capacity was found in one condenser over four times the minimum capacity. The range of capacity may be greatly increased by dividing the condenser into three or four sections, so arranged as to permit their being thrown in multiple by a suitable switch; the adjustment can be arranged to be perfectly continuous throughout the larger range.—*Phys. Rev.*, July.

Transparency of Liquids to Electric Waves.—FLEMING.—A communication, referring to the paper of de Heen, noticed in the Digest Aug. 4, where carbon bisulphide is classified as one of the opaque liquids, and the difference between liquids as to transparency and opacity is said to correspond with no other physical differences. Fleming refers to his own experiments (Digest, June 23), in which he had found that carbon bisulphide is particularly transparent to electric waves; also that liquids of a large and abnormal dielectric constant are opaque, those of a small dielectric constant are transparent, and that all liquids containing in their chemical molecule radicals such as H O, N O_2, and other easily replaced atomic groups, have large or abnormal dielectric constants and considerable absorptive power for electric waves. He now describes an interesting experiment which indicates that large dielectric constant *per se* is not the determining cause of opacity, but the opacity is really due to a sort of consequent good conductivity for high frequency oscillations. A number of thin glass tubes, like small test tubes, were filled with water and packed side by side in a wooden frame; by thus laminating the water, the conductivity of the mass in directions along and across the tubes was made very different, whereas owing to the thinness of the glass and its high dielectric constant the resultant dielectric constant of the mass was not so much altered in the two directions. When tested for electro-optic opacity, this system of water tubes was found to be opaque when the length of the tubes was held parallel to the electric force, but transparent when so held that the tubes were placed perpendicular to the electric force. This experiment seems to indicate that all liquids of high dielectric constant may be looked upon as good conductors for exceedingly rapid electric oscillations, but that this conductivity cannot be inferred merely from experiments with steady or low frequency alternating currents. It is, however, possible to distinguish between the qualities, and to make a liquid appear as if it were electro-optically transparent, even if it has a high dielectric constant, by, so to speak, laminating it like a dynamo armature. He found the same to be the case with a metal wire grating.—Lond. *Elec.*, July 20.

The Spark Length of an Induction Coil.—BEATTIE.—An account of an investigation of the relationship of the secondary spark-length in an induction coil to the conditions which obtain at the primary break, especially of the dependency of the length of the secondary spark upon the nature of the primary poles, the rate of break, and the e. m. f. in the primary circuit with no condenser across the break, or with condensers of various capacities across the break. The results are given in tables and diagrams. As regards the material of the poles, other things being equal, some substances, like platinum, give a much longer spark than others, like carbon; this is the result of carbon being a readily disintegrating or easily arcing substance, and so setting up at the primary break a heavy arc, which, by bridging across the gap, renders the rupture less abrupt. A quick break at the primary corresponds to a long, and a slow break to a short secondary spark. As to the value of the primary e. m. f., platinum and copper poles give a shortened secondary spark for an increased primary e. m. f., while carbon, zinc and lead poles behave differently, for with them the spark-length sometimes, i e., when the break is slow, actually increases as the e. m. f. is raised. By the introduction of a condenser in parallel with the primary break the length of the secondary spark is, as a rule, much enhanced. Over the range which his experiments cover, the best capacity of the condenser (which gives the maximum spark-length), as well as the maximum spark-length, is independent of the primary e. m. f. But both best capacity and maximum spark-length are very greatly affected by the nature of the primary poles; the more easily disintegrable their character, the greater is the capacity needed to give the longest possible spark. As to the effect of varying the rate of break, the tendency is for the best capacity to decrease and the

maximum spark-length to increase, as the break is quickened; this is best seen with carbon, less distinctly with copper, while with platinum-platinum and platinum-mercury breaks the best capacity and the maximum spark-length appear to be unaffected by the quickness of the break. The behavior of zinc is altogether anomalous: an increase in the quickness of the break is accompanied by an increase in the best capacity; moreover, for certain capacities a quick break may actually give a shorter spark than a slow break; this behavior of zinc is probably connected in some way with its non-arcing properties.—*Phil. Mag.*, July.

Conductivity of Flames.—WILSON.—An illustrated account of an investigation of the electric conductivity of flames containing vaporized salts. After a description of his apparatus he discusses the relation between the current and the e. m. f. in the flame, the distribution of the potential between the electrodes, the formation of ions in vaporized salts, the relative velocities of the ions in flames, and the relative velocities in the ions in hot air. There is a close analogy between the conductivity of flames containing vaporized salts and that of luminous rarefied gases. In both cases the drop of potential is greater at the negative electrode than at the positive electrode, while it is small in the centre. It is, therefore, probable that the peculiar distribution of the potential in rarefied gases, as well as that in flames, is due to the great difference of the velocities of the positive and negative ions.—*Phys. Zeit.*, June 9.

Electrostatic Lines of Force.—ROGERS.—A brief, illustrated description of a method, suitable for lecture demonstrations, of studying electrostatic lines of force. He uses an "electrostatic needle," mounted on a rigid axis. In its most convenient form the needle consists of a small rod of hard rubber pierced at the centre and provided with small gilt pith balls at its ends; it is mounted on an axis consisting of a pin stuck into a handle. The pith balls are oppositely charged by contact with the poles of an electrical machine. While so charged the electrostatic needle behaves in an electrostatic field just as a magnetic needle does in a magnetic field.—*Phys. Rev.*, July.

REFERENCES.

Electric Discharges.—TROWBRIDGE.—An illustrated description of experiments made with his battery of 20,000 storage cells. He describes some forms of electric discharges, which he has obtained, and the production of X-rays by a steady current (Digest, June 16).—*Sc. Amer.*, July 28.

Resistance of Thin Films.—LONGDEN.—The first part of a long, illustrated paper on the electric resistance of thin films deposited by cathode discharges. It appears to be a fuller account of his investigation, described more briefly in his article abstracted in the Digest June 16. In the present part he describes in detail the method of deposition of the films.—*Phys. Rev.*, July.

Conduction of Flames.—MARX.—An illustrated preliminary account of an investigation of the electric conduction of flames of gases in a magnetic field. Electric conduction of flames of gases can be considered in a manner analogous to electrolytic conduction, by the ionization theory.—*Phys. Zeit.*, June 2.

ELECTRO-CHEMISTRY AND BATTERIES.

Thermodynamics of the Voltaic Cell.—CARHART.—A paper giving a generalization of Helmholtz's formula for the relation between the electrical energy output of a reversible cell, the heat equivalent of the chemical reactions, and the temperature coefficient of the cell. He treats the positive and the negative sides of a voltaic cell separately, the cell being so constructed that the temperature of one side can be varied independently of the temperature of the other side. The result he arrives at, is that the heat which must be added to a cell or abstracted from it to keep its temperature constant while a certain quantity of electricity is passing through it, is equal to this quantity of electricity, multiplied by the absolute temperature, multiplied by the sum of the two temperature coefficients: one is the temperature coefficient of the postive side of the cell, the temperature of the negative side remaining constant; the other is the temperature coefficient of the negative side, the temperature of the positive side being maintained constant; their sum is the temperature coefficient of the cell as a whole, neglecting any small coefficient due to the thermoelectric force at the junction of the two halves of the cell. For a Daniell cell the temperature coefficients of the two halves are nearly equal, but of opposite sign; therefore, the temperature coefficient of the whole cell is about zero, as is well known. In the second part of the paper he describes experiments made with a Daniell cell to confirm his theory.—*Phys. Rev.*, July.

Progress in the Soldering of Storage Batteries.—SCHMIDT.—An article showing the disadvantages of binding screws for joining the plates of a storage battery with the connecting bars; he recommends to make the joints by soldering, as in this way absolutely sure contacts are obtained which are not affected by the acid vapors of the storage battery room. The soldering is done in two ways: either with the soldering iron by means of a solder easily fused, or with lead and the hydrogen flame. The first method does not require the transport of heavy apparatus, but the solder containing mercury has great disadvantages, and a contact made in this way is not so good as one made with lead. The second method is, therefore, in a more general use. The author has used for some years for soldering purposes hydrogen and oxygen produced by the electrolytic decomposition of water. The use of these gases is said to have so great advantages that it has been introduced in the most plants manufacturing Tudor storage batteries. The temperature of a flame supplied with hydrogen and oxygen is higher than with the use of air; for one volume of hydrogen about one-third volume of oxygen must be supplied to the flame against two and one-half volumes of air, so that the soldering can be hone in half the time and with half the consumption of gas. The average consumption per hour is twenty-six gallons of hydrogen and nine gallons of oxygen.—*Centralblatt fuer Accum. und Elem. Kunde*, June 15.

REFERENCES.

Electrolysis of Alkali Chloride Solutions.—FOERSTER and SONNEBORNE.—An account of an investigation of the production of oxygen at the anode by the electrolysis of alkali chloride solutions. They describe the apparatus used and give the results in tables. They conclude that the chlorate and oxygen produced in the electrolysis of neutral and not too dilute alkali chloride solutions, with or without diaphragm, are nearly exclusively secondary products, the primary products being hypochlorite and hypochlorous acid respectively.—*Zeit. fuer Elektrochemie*, June 21.

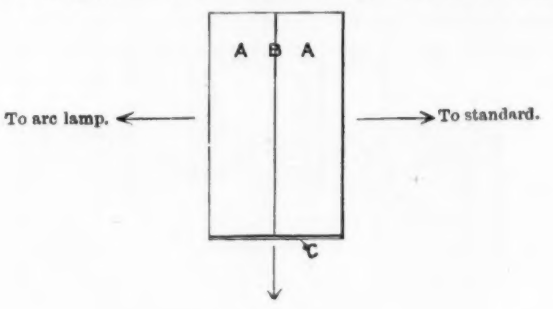
Electrolytic Oxydation.—ELBS and BRUNNER.—An account of researches on the electrolytic oxydation of certain alcohols.—*Zeit. fuer Elektrochemie*, June 21.

Production of Phosphorus by Electrolysis.—An illustrated description of an apparatus devised by Dill for the production of phosphorus by electrolysis of phosphoric acid, mixed with carbon powder. The feature of his method is said to be that the process is continuous.—*Elektrochem. Zeit.*, June.

Electrolytic Production of Hydrogen and Oxygen.—An illustrated article on an electrolyzer of Schoop without diaphragm, which is said to yield 17 gallons of hydrogen and 34 gallons of oxygen per hp-hour.—*Elek. Neu. Anz.*, June 1.

UNITS, MEASUREMENTS AND INSTRUMENTS.

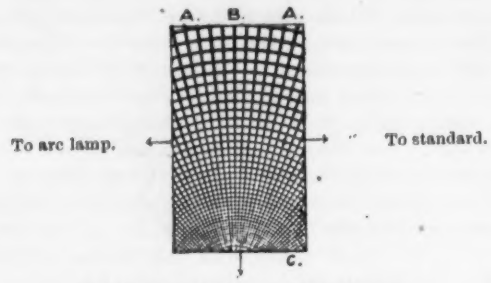
Photometry of Arc Lamps.—CARTER.—A continuation of his illustrated article, noticed in the Digest Aug. 4.—He continues the description of the arrangement of apparatus in the photometer room. He considers the illumination due to two lights to be equal when black print on white paper can be distinguished equally well by either. On



PLAN OF PHOTOMETER.

this principle is based a "distinctness" photometer, in which a meshwork of black lines seen on a white ground is substituted for the print on white paper. The essential feature of the photometer is an addition which might be made to one or any form in which a comparison is made between the illumination of two areas, one of which is illuminated wholly by the arc lamp and the other wholly by the standard lamp, for instance, the Joly photometer, as shown in plan and in front elevation in the adjoining figures. *A, A* are equal blocks of paraffin wax or of milk glass, separated from one another by a thin plate of metal foil *B*. One block is illuminated by the arc and the other by the standard, and the effect is viewed from the front *C*. To this front is attached a plate marked with a graduated mesh or

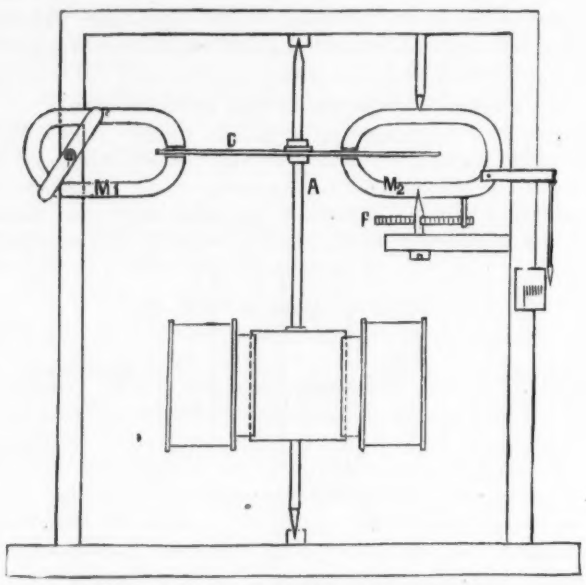
other convenient pattern, as shown in the illustration below. To use the photometer, seek the level at which the mesh becomes so fine as to begin to be indistinct, and move the photometer until this level is the same on the two sides of the centre line. It is not advisable to peer too closely at the mesh in order to see the finest squares, but better to run the eye rapidly from the coarse squares at the top of the diagram downwards until the first impression of indistinctness is obtained, and to set the photometer from that. This saves the eyes, is quicker and



FRONT ELEVATION OF PHOTOMETER.

gives results at least as accurate as can be obtained by judging from the very smallest squares that can be seen. He says that the results that this form of photometer gives have at least the accuracy that the variable nature of the arc permits to aspire to; they far excel in definiteness any obtained by attempting to directly compare the illuminations, and depend much less on the judgment of the observer. He gives in a table the results of some tests.—Lond. *Elec. Rev.*, July 20.

Damping of Eddy Currents.—An illustrated description of a damping device for motor meters which does not act in strict proportionality with the speed, but has a greater damping action at medium speeds than at slow or high speeds within a certain range of speed; this is desirable, because with strict proportionality the indications of the motor meter would be wrong, as the rotation would be too slow for low speeds on account of the friction, and also too slow for high speeds on account of the air damping and counter e. m. fs. A device of this kind, used by Hartmann & Braun, is illustrated in the adjoining figure. The metallic disk *C* rotates around the axle *A* be-



INSTRUMENT FOR DAMPING EDDY CURRENTS.

tween the pole pieces of the magnets M_1 and M_2; M_1 is fixed, while M_2 is liable to rotate, its position being determined by the spiral spring *F*. By the rotation of the metallic disk eddy currents are induced in it, which try to hinder the rotation; besides, the magnet M_2 is deviated in the direction of the rotation of the disk, and the angle of deviation is the greater, the greater the speed of the disk. The damping action of M_2 is different from that of M_1, as at M_2 the point of application of the damping forces is changed and is removed more and more from the axle *A* with increasing speed, so that the damping action increases more rapidly than the speed, until the pole pieces of M_2 reach the rim of the disk, which produces again a decrease of the damping. The damping action may be modified at will by modifying the thickness of the rotating disk at different distances from the axle.—*Elek. Rund.*, June 1.

REFERENCES.

Alternating Current Measuring Instrument.—An illustrated description of a measuring instrument for alternating currents of Schuckert & Co., in which in a short-circuited movable coil currents are induced by a magnetic field generated by the current to be measured; the feature of the instrument is the arrangement of the magnetic circuit.—*Elek. Rund.*, June 1.

Measuring Instrument for Tramways.—KAPP.—See the abstract under Traction.

New Books.

MESURE DES GRANDEURS ELECTRIQUES DANS LES CIRCUITS À COURANTS ALTERNATIFS. By Omer De Bast. Liege, 1899. Paper, 62 pp.; 21 illustrations. Price, 2.50 fr.

This little book deals with the quantities which are met with in alternating-current circuits, such as pressure, current, resistance, reactance, etc., as well as the instruments for measuring them. It considers such measurements from the standpoint of a teacher and of laboratory measurement. The description is clear and good. The cuts are, however, very inferior, and some of them seem to be mere sketches.

TRANSFORMATOREN FUR WECHELSTROMUND DREHSTROM. Eine Darstellung ihrer Theorie, Konstruktion und Anwendung. Von Gisbert Kapp. Zweite ver mehrte und verbesserte auflage. Berlin: Julius Springer. 282 pages, 165 illustrations. Price, 8 marks.

The second edition of this book on transformer design contains two new chapters, and others have been modified and enlarged over those in the first edition; additional curves for iron losses have been added; those for hysteresis and Foucault currents are given separately from one another, etc. The book, which is an excellent treatise on transformer design, bears in every part the stamp of the practical engineer, is well worth discussing more in detail, especially for the benefit of those electrical engineers who are not familiar with the first edition.

BOOKS RECEIVED.

THE MINERAL INDUSTRY. Its Statistics, Technology and Trade. Vol. VIII. By Richard P. Rothwell. New York: The Scientific Publishing Company. 986 pages. Price, $5.00.

A HANDBOOK OF THE ELECTROMAGNETIC TELEGRAPH. By A. E. Loring. D. Van Nostrand Company. 116 pages. Price, 50 cents.

DAS PUMPENVENTIL. By Otto H. Mueller, Jr. Leipsig: Arthur Felix. 157 pages, 41 illustrations. Price, 5 marks, paper; 6 marks, cloth.

The "Column" Indicating and Recording Instruments.

A type of meter which differs greatly from those now in common use has lately been brought out. Much painstaking investigation and experiment have been expended on it, and the claims for its accuracy, permanence, compactness, legibility and general reliability are perhaps not too strongly expressed. The radical distinction between this and the ordinary type is that the variations in the current to be measured control the variation in pressure of a body of air in a closed vessel. This latter variation is indicated by the change in height of a column of non-volatile liquid which rises and falls in a glass tube backed by a scale. A recording instrument of the same type is made, the record being traced by a float-supported pen which follows the movements of the liquid's surface.

In Figs. 1 and 2 are shown the details of the two styles of "Column" instruments. Fig. 1 illustrates the plain indicating meter. A small air pump, to be described later, supplies air at a pressure of about 1¾ lbs. per square inch to the orifice, *A*, in the chamber, *B*. The air then flows through a series of porous diaphragms made of filter paper whose prime function is to serve as an air resistance, but incidently remove any dust particles, and then enters the passage, *D*, into which is drilled the opening, *E*, which is capped by the valve, *F*.

The valve itself consists simply of a small flat disk of non-oxidizable metal, *F*, resting on a circular seat with escape ports, *G*, below it, and a pin, *H*, resting on top. On the pin rests a spool, *J*, carried by one end of the lever, *I*, on the other end of which is a counter-weight,

K, by means of which the effective weight on the pin, *H*, can be adjusted.

The spool is wound with wire through which the current to be measured is passed, this being done by means of the two short thin copper ligaments, *L*, which support and form the fulcrum about which the lever can oscillate.

A magnet, *M*, furnishes a field of force such that the reaction between it and the current forces the spool down with a force increasing as the current increases. The valve, *F*, is thus a variably loaded safety valve whose blowing-off point is constantly and proportionately varied by the current variation. The counter-weight, *K*, on the lever is so adjusted that when no current is passing through the spool the weight on the valve pin is such that the blowing-off pressure in *D* is one sufficient to force the liquid in the closed chamber, *N*, up through the glass tube, *O*, to a height, *R*, which is the zero of the scale. The pressure cannot go above this when no current is on, as any tendency to increase simply results in lifting the valve slightly higher, whereupon more air escapes and the pressure falls back; nor can it go lower, as if there were this tendency the valve would partially close because of the spool weight and the less rapid escape of air through it would cause the pressure to build up again because of the constant flow of air from the high pressure supply at *A* through the air resistance, *C*.

Exactly the same thing holds good when the weight on the valve is that due to the non-counterbalanced portion of the spool weight plus the downward thrust caused by a given current through it. This gives what is practically a heavier loaded safety valve so that the blowing-off pressure in *N* is higher, and this higher pressure of course forces the liquid up farther in the glass tube, thus showing the presence of a current. The height to which the liquid rises is directly a measure of that current because the extra downward thrust on the spool is, from the magnetic field and spool design, proportionate to the current.

The air resistance, *C*, not only prevents the action from being so sudden that the indications are not dead beat, but in the case of a decrease in current strength allows the air in the closed chamber, *N*, to flow back promptly and so register the decrease instead of having the greater part of the escaping air furnished from the higher pressure source, *A*. The glass tube being but 24 ins. long, the pressure at *A* (equivalent to about a 49-in. column of the liquid) is always sufficiently in excess of that in the passage, *D*, and the chamber, *N*, to cause the changes to be promptly registered.

From the foregoing it is seen that the zero adjustment is made by screwing in or out the counter-weight, *K*, thus shifting all scale values an equal distance up or down the tube. For actual calibration at the maker's an iron screw, *S*, of heavy cross section is provided, which on being brought closer to or farther from the opposite leg of the magnet weakens or strengthens the field in which the active spool works by shunting a portion of the lines.

The total motion of the spool is exceedingly small—less than a hundredth of an inch, in fact—and therefore there is not only no spring action of the suspending ligaments, the action in this particular being like that of the Kelvin balance, but as the spool acts always in the same field, the pressure it exerts on the valve and hence the air pressure in *N* and the resulting liquid column height are exactly proportional to the current strength. In other words, the scale divisions are evenly spaced.

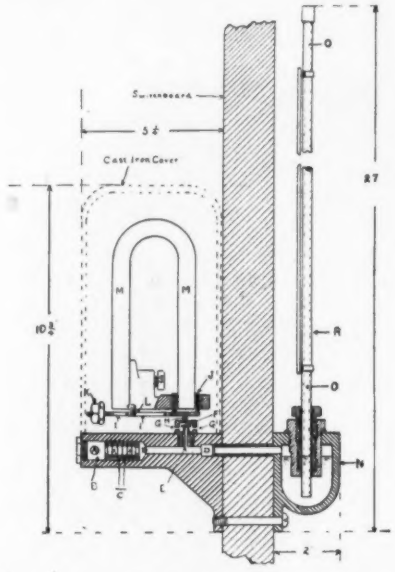


FIG. 1.—SECTION OF INDICATING METER.

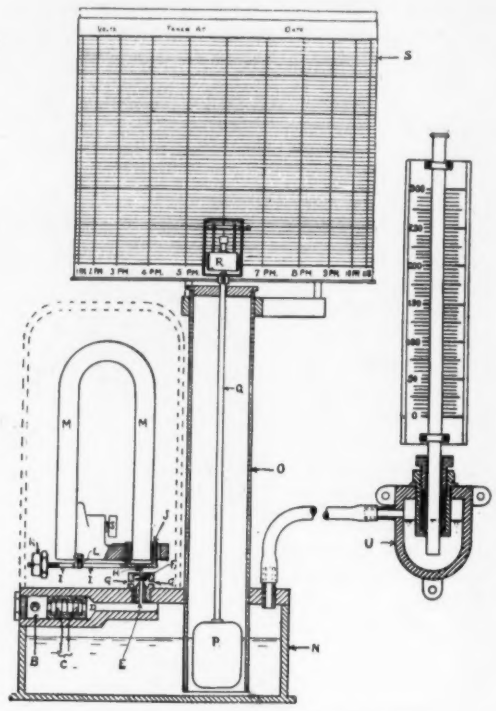


FIG. 2.—SECTION OF RECORDING METER.

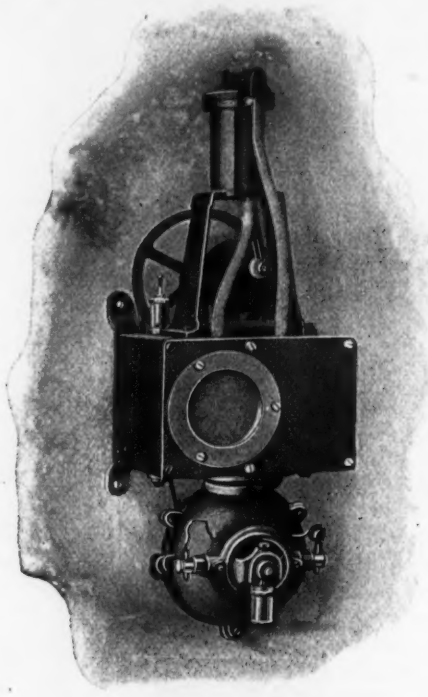


FIG. 3.—ELECTRIC AIR PUMP.

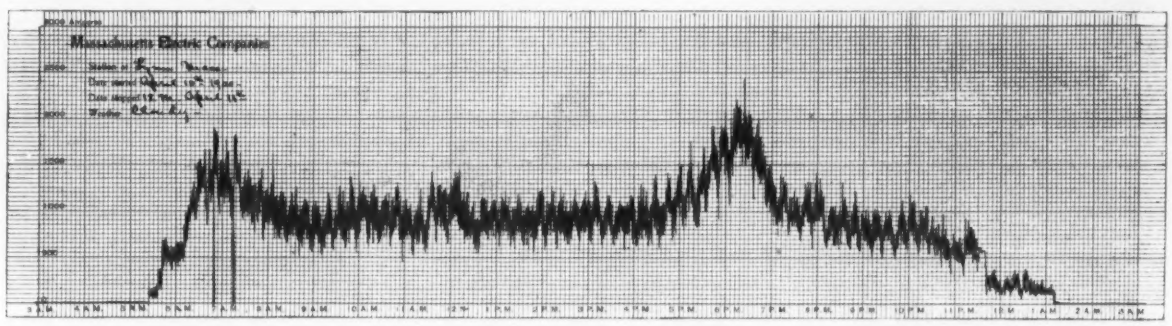


FIG. 4.—RECORD—¼ SIZE.

It should also be noted that the only work that the varying current has to perform is to *control* the air pressure, the actual energy required to move the liquid and so show the variation being supplied by an independent source whose power is, comparatively speaking, unlimited.

The length of the instrument scale that has been adopted as standard is 18 ins. from the o to the maximum reading and this, combined with the conspicuous color of the liquid employed (a mineral oil that

is colored a deep, clear red or a dark yellow, as may be desired) results in making the indications exceptionally legible.

Within extremely wide limits, variations in the pressure of the air supplied to the instrument through the pipe which enters at *A* have no influence whatsoever on the accuracy of the meter readings, this being because it is the *weight* on the safety valve and not the *quantity* of air flowing through the valve that determines the blowing-off pressure of the air in the passage, *D*, and the closed chamber, *N*, and therefore the height to which the liquid rises in the tube. As long as the supply pressure is sufficiently in excess of the blowing-off pressure in the closed chamber to cause a continuous flow of air to take place through the air resistance, *C*, the meter will therefore indicate correctly, although the rate of speed of the column movement when the current strength measured changes will be slightly less or greater as the supply pressure is lowered or raised.

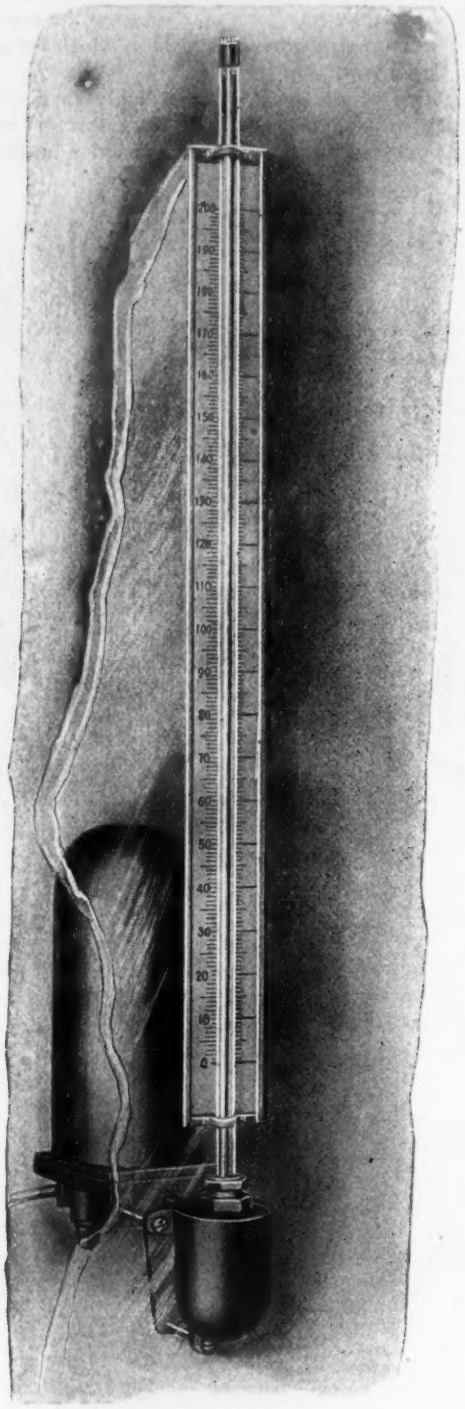


FIG. 5.—THE DIAL.

Experience has shown that dial illumination is entirely superfluous with this construction of instrument, as the liquid is an excellent reflector of itself and the ordinary station illumination renders it visible at great distances. The space occupied by the column-type meters is very small; the extreme over-all width is 2¾ ins., and owing to the design of the magnet fields and the effective shielding of the iron protective caps over them, they can be mounted on centres but 3 ins. apart without mutual interference. The space occupied behind the board (see Fig. 1) is but 2¾ ins. broad by 10¾ ins. high and on the face of the board 2¾ ins. by 27 ins., and the drilling required for mounting is only three holes of 3-16-in. diameter to hold the mechanism in place, and one of 5-16-in. diameter through which the passage connecting the chambers *D* and *N* goes.

The recording meters are exactly the same in principle as the indicating type just described. Instead, however, of employing a rising and falling liquid column in a glass tube to give visual indications of the current changes, the column is made of much larger diameter and carries a hollow float supporting a rod with a pen at the extremity thereof, which in turn traces a line on a sheet of paper carried before it.

By making the column diameter of a proper size a float can be used of such power that the pen friction becomes negligible compared to it and not only this, but the pen can be made to carry a large supply of ink sufficient for long records without having this varying weight destroy the accuracy of the indications.

A section of this recorder is given in Fig. 2, similar parts being lettered the same as those in Fig. 1. It will be noted, as above stated, that the only additions comprise the float, *P*, the rod, *Q*, and the pen, *R*, together with the drum, *S*, which is rotated one inch an hour by internally placed clockwork, and to the surface of which is secured the record paper. The paper is held firmly by inserting both ends in a slotted roller that is flush with the surface of the cylinder and turning the roller until the paper is drawn tight. A pen stroke of 6 ins. for the recorder scale and a drum circumference of 24 ins. have been adopted. A record reduced to one-quarter size is illustrated in Fig. 4.

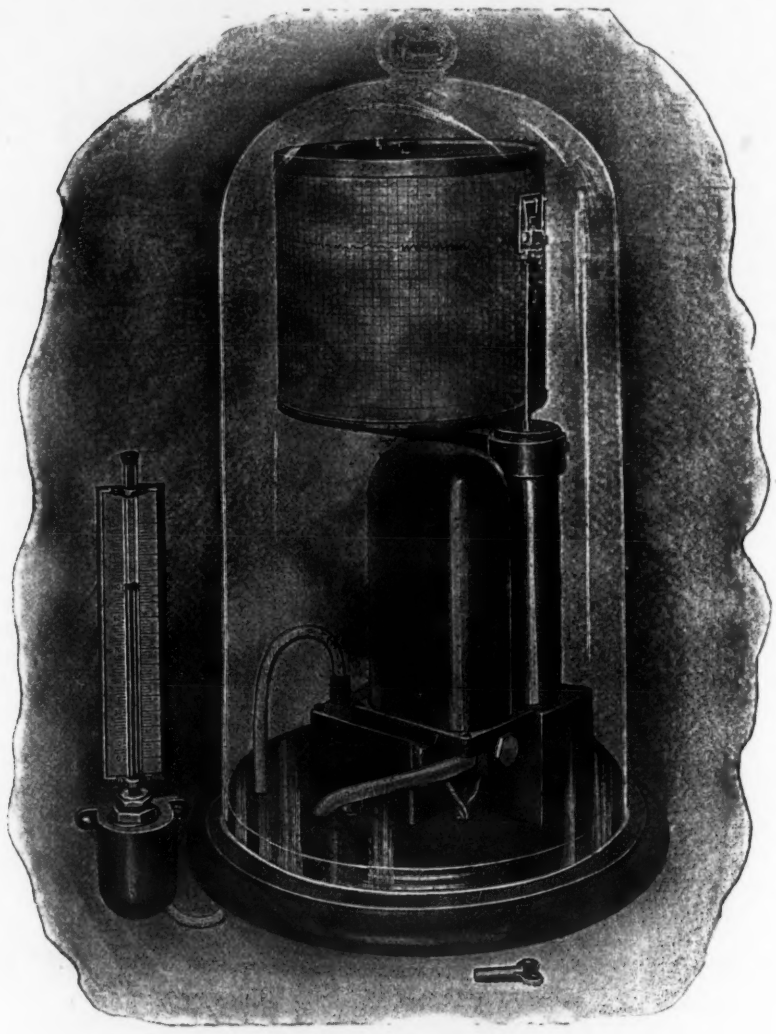


FIG. 6.—RECORDING METER.

Owing to the absolutely dead-beat indications which this class of apparatus gives, the meters never run over, i. e., any fluctuations shown by them are true fluctuations and their values are not added to by the inertia of the moving parts. The extreme sensibility of the instruments makes a 20 to 25 millivolt drop for full scale indication in an ammeter perfectly feasible. There is ample margin for adjustment and one is able to standardize all these instruments so that the same

drop is required for each, thus making all shunts strictly interchangeable and all meters, whatever their range, intercomparable—points which are of great importance.

Another unique feature that these devices possess is that by drilling an additional hole through the cap forming the top of the chamber in which the liquid is contained and connecting this by a tube with a second closed vessel, *U*, similar to *N*, in Fig. 1, the liquid in the tube dipping into this vessel will rise and fall with the rise and fall of the pen as the variation in the pressure of the air therein is the same as that in the recorder chamber. In this way it is possible to put the recorders themselves in the superintendent's office or elsewhere so that they cannot be tampered with, and place the pilot indicator on the switchboard so that the attendant will have before him a constant indication of what the recorder is doing. He cannot, as would be the case if an independent instrument were furnished for his use, claim that this does not check with the recorder, as his is actuated by the same controlling mechanism. Any number of these pilot stations can be provided.

To furnish the air required for the operation of the column type of instruments, one of two separate types of devices is supplied. The first, shown in Fig. 3, is a simple, single cylinder, single-acting air pump mounted on a square iron box which serves as an air reservoir and driven by a 1-20th-hp motor suspended underneath and connected to the pump by a belt. This type is of sufficient capacity to run fifty indicators or twelve recorders, the construction of the latter being such that they require nearly four times as much air as the former.

The motor can be furnished for either a 110 or a 220-volt circuit, and for either direct or alternating current, as may be desired.

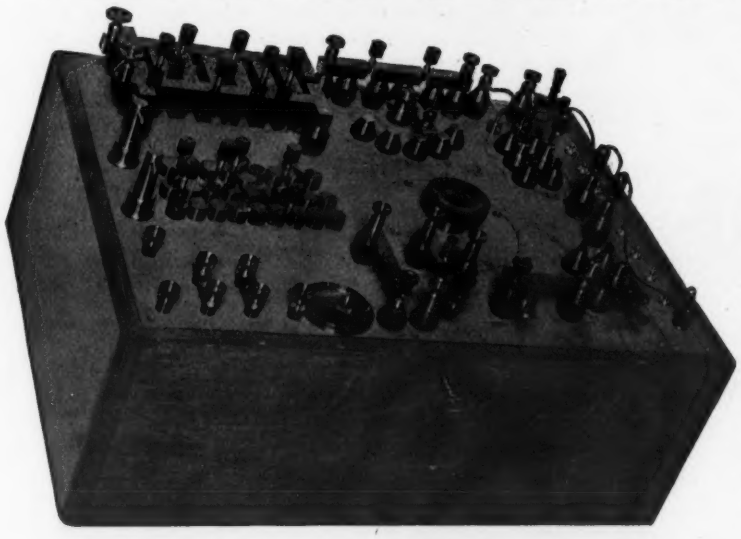
The second type is a water-operated compressor which operates like an injector, the water carrying the air with it and compressing it to the desired point. These require about ten gallons of water per hour per instrument with 3 ft. head, and are built in sizes to suit the particular installation.

The apparatus described above is being manufactured by the Whitney Electrical Instrument Company, and introduced by Machado & Roller, of 203 Broadway, New York City. As shown by the general views, the company has succeeded in giving a handsome appearance to the instruments, while it is ready to prove that their operation will be as satisfactory.

A type of instrument for use on alternating current is also made which differs slightly from the foregoing, but employs the same principle.

The Fisher Cable Testing Set.

With an increasing use of both overhead and underground cables for telephone, electric light, power and other service, comes a corresponding demand for apparatus to test the qualities of these cables. viz., insulation, capacity, resistance. One of the most recent instruments for this purpose is the Fisher cable testing set, illustrated herewith. This apparatus was designed by Mr. Henry W. Fisher, chief engineer of the Standard Underground Cable Company, Pittsburg, and results from long experience in work of the character indicated.



CABLE-TESTING SET.

The most prominent feature of the instrument is a "master switch," by means of which connections are automatically changed from one class of measurements to another, and thus it is possible for the operator to make rapid and accurate tests whether in a laboratory or out of doors. Any one who has had experience in cable testing will appreciate the great value of this freedom from the considerable number of connecting wires which, under ordinary conditions, must be changed whenever it is desired to test insulation or ordinary resistance, as well as capacity. The component parts of the Fisher set are:

(a) Standard condenser of multiple-series type, with range from .02 to .5 microfarad. (b) High resistance of 100,000 ohms in two coils of 30,000 and 70,000 each. (c) Wheatstone Bridge and resistance box of "Decade" or "Post Office" pattern. (d) Horizontal D'Arsonval galvanometer. (e) Ayrton universal shunt. (f) Special "master" switch. (g) Short-circuit and other keys. (h) Galvanometer and battery reversers. (i) Dry battery of 10 cells.

The whole set is compactly mounted in a handsome carrying case, the lid of which is removed when tests are made. For ordinary requirements the outfit is complete in itself, but for measuring high insulation or capacity, it is desirable to use a separately-mounted, high-sensibility D'Arsonval galvanometer and an independent battery of 50 or 100 cells. The apparatus is manufactured by Morris E. Leeds & Co., and sold through their general selling agent, James G. Biddle, 1038 Drexel Building, Philadelphia.

Enlarging the Gould Pump Plant.

Though the Gould Manufacturing Company, of Seneca Falls, N. Y., has an extensive plant, it found early this year that its facilities for manufacturing were entirely inadequate to fill the constantly increasing demands for its large power pumps. Accordingly it decided to erect a large plant for the manufacture of heavy power pumps. The plant occupies six acres of land alongside of the New York Central Railroad at Seneca Falls, N. Y. The buildings are already completed, and the plant will be in operation in about three months. The old factory of the Gould Manufacturing Company will be devoted to the manufacture of small pumps of every variety for which this company is famous. The new plant will employ about 400 men, and will be operated entirely for the manufacture of heavy power pumps of any capacity, built according to specifications. The plant is modern in every particular. A railroad track runs through the main building and a heavy electric crane will be used for the loading and unloading of cars. A complete iron and brass foundry is also being erected. One unique feature of this plant is its testing department. One hundred and fifty horse-power can be obtained at a moment's notice for testing purposes. Every pump will be tested before it is shipped to see that it comes up to the requirements. In about three months this company will be in shape to consider propositions for the building of pumps of any capacity.

Improvements in Tool Steel.

The Bethlehem Steel Company gave an exhibition last week of its Taylor-White process tool steel, a subject of general interest to the electrical and machinery industries, and one which has already arrested the serious attention of engineers and machinists. The process consists in the treatment of the tool after it has been forged, and which imparts to the steel the very valuable and exceptional property of retaining a high degree of hardness when heated to a visible red. It is possible with one of these tools to cut steel at a speed so great as to heat up the point of the tool to redness, and have it continue to cut several minutes at this speed, leaving an unusually smooth finish on the work, as well as cutting accurately to size. The practical speeds at which these tools will run have been found to be from two to four times that of any steels with which the company have experimented. The process is in no sense one of surface hardening. After the tool has been dressed or machined to shape and the process applied, the penetration is to the centre of the steel, even in tools as large as 4 ins. square. In other words, the centre of the tool is in precisely the same condition as those portions near the surface. This special steel forges so much more readily than the general run of self-hardening steels that tools of difficult shapes may be easily formed. The thorough penetration effected by the process insures the use of the tool until it becomes so small, by reason of regrinding, that it cannot be held in the machine. This special steel can be annealed so that it can be easily machined to shape, making it applicable to twist drills, chasers, inserted cutters, etc. The tools made in accordance with this method

are also extremely uniform in quality, so that the work on which they are used can be regularly performed at the maximum rate of speed.

When these tools were introduced in the shops of the company it was found necessary to overhaul the entire plant. In many cases it is impossible to operate the machines at the speed desired, and at the same time take the heavy cut of which the tool is capable. The main lines of shafting have been speeded from 90 to 250 revolutions, and further changes in countershafts have been made to speed up individual machines, this combination being largely responsible for the increased efficiency of the shop. The following table, furnished by the Bethlehem Company, shows the increase in efficiency of each tool per hour in terms of metal removed:

Average.	October 15, 1898.	May 11, 1899.	January 15, 1900.	Gain in per ct. cut of third over second.	Gain in per ct. cut of third over first.
Cutting speed	8 ft. 11 in.	21 ft. 9 in.	25 ft. 3 in.	16	183
Depth of cut	0.23 in.	0.278 in.	0.30 in.	8	30
Feed	0.07 in.	0.0657 in.	0.087 in.	32	24
Pounds of metal removed per hour	31.18	81.52	137.3	68	340

At the recent tests and exhibition an unusually hard and gritty piece of cast iron, about 7 ft. long by 8 ins. in diameter, was placed in the lathe. A heavy cut was taken on this for 15 minutes with a special process tool. At the end of that time the cutting edge of the tool showed no signs of wear, the only effect being a discoloration in the vicinity of the cutting edge. A tool of the same shape, made of Mushet steel, and taking the same cut at the same speed, lasted only 22 seconds. A steel shaft was then placed in the lathe and run at a cutting speed of 150 ft. per minute. The edge of the special tool became visibly red, and yet was uninjured after having been run four minutes. Under the same conditions a Mushet tool fell down completely in six seconds. Exhibitions were also made of the extraordinary properties of this steel in heavy cuts at fast speeds in planer work, on both hard and soft steels, on forgings of different grades of steels, and with chasing tools making armor plate bolts. A 1⅜-in. twist drill made by the company has been run through 4-in. armor plate at the rate of 250 r. p. m., both tool and plate being red hot, and yet the tool receiving no damage. Although an ordinary drill went through the plate, it was chewed up in its passage.

A great advantage in the use of these tools is that when cutting dry at the rate of maximum efficiency the chips should come off blue. These blue chips enable the foreman, at a glance, to tell whether the work is being done at the proper speed. When running under water at the correct cutting speed the chips should show blue immediately upon shutting off the water and allowing the tool to cut dry for a little while.

A comprehensive idea of the wide application of this steel, as far as forging is concerned, was obtained in the tool room. Almost every shape was here represented from the plain simple forging to the most intricate. One particular specimen was a hollow drill used for removing test pieces from armor plates. The cutting lips had been machined to shape in the final process.

The company will be glad to undertake desired experiments, and have a special lathe for such work, driven by an independent 40-hp Westinghouse motor. This lathe can be run at from 200 r. p. m. to 300 r. p. m., and will take work up to 60 ins. in diameter.

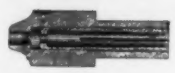
The Naval Electric Company.

The Naval Electric Company, with offices at 95 Liberty Street, New York City, has been organized to succeed the B. & H. Electric Company, of Dansville, N. Y., and New Haven, Conn. The same officers continue, the change in name being made as more appropriate for the distinctive line of electrical business in which the company proposes to engage. F. G. Hall, Jr., A.S.M.E., is the manager, and I. E. Burdick, secretary and treasurer. Both have been engaged in the electrical business for about ten years, and have devoted their attention more especially to the application of electricity to naval and marine purposes. They are graduates of the Sheffield Scientific School, and at the beginning of the war with Spain came into prominence by their joint invention of an arc light for use under water, and known as the Yale submarine arc lamp. This lamp is being placed on the market by the company, which is negotiating for its adoption in all foreign navies, and by various steamship companies at home and abroad. Another specialty that is being placed on the market by the company is known as the B. & H. rapid-fire electric saluting yacht cannon, made after the style of the Hotchkiss gun, with a new electric firing attachment for firing from any part of a yacht.

The company prepares specifications for marine electric lighting and power plants, in accordance with the National Electrical Code, and will make a specialty of the installation of marine electrical apparatus aboard ships and yachts. It will supply general naval electric specialties and staples. The company has foreign connections and will purchase for export. Manufacturers are invited to submit prices.

Garton Trailer Connector.

The device illustrated herewith is used very extensively as a trailer connector on electric railways, and is also being used for plugging in wires and in many other ways in electric light and railway work. Another use to which it is applicable is that of plugging in changeable headlights, in connection with extension cords, for portable ammeters, drills, etc., in which use it is said to be giving much satisfaction. It is one of the most important features of this connector that there are no exposed live parts. This device is manufactured by the W. R. Garton Company, Chicago, Ill. This concern is constantly bringing out new specialties which appear to be just what is needed, judging from the successful results obtained in marketing the same. Although it originally entered the railway field, it has established a substantial business in the electric light, power and telephone industries.



CONNECTOR.

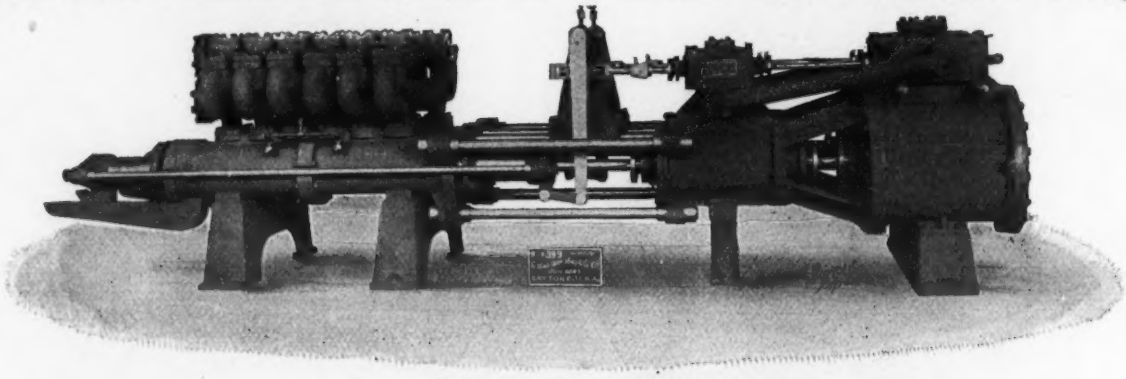
Compound Duplex Pressure Pump.

The accompanying illustration is of a compound duplex pressure pump, designed by the Stilwell-Bierce & Smith-Vaile Company, Dayton, Ohio, to develop a maximum pressure of 700 lbs. per square inch.

The liquid end is of the end-packed trombone style, the cylinders being made of special metal. Mounted thereon are separate chambers for the location of the valves, the chambers also being constructed of special metal and designed with a view of facilitating quick access for the inspection of the valves.

The valves are of the hydraulic pattern, made of steel, and guided from below. An extension piece is provided for supporting the water plunger, and an approved adjustment device provided therefor. The water end is mounted on heavy supporting columns.

An engine of the transposed cylinder type is furnished, giving free access to all steam pistons without dismantling the pump. The outside valve adjustment is a feature of this design.



COMPOUND DUPLEX PUMP.

NEWS OF THE WEEK.

Financial Intelligence.

THE WEEK IN WALL STREET.—The stock market was dull to a marked degree during the week, the dullness being accompanied by fluctuations in the movement of prices. The fear that the Chinese complication and the presidential campaign will unsettle prices seems to hang over the market with a deterrent effect, and the public was indisposed to touch stocks except in the way of investment. The loan market was quiet, call money being abundant at 1¼@1½ per cent. Time loans were in moderate demand at 4½ per cent on arrangements for four months or more, and 3¼@4 per cent for shorter periods. A small business was done in mercantile paper, the rates being based on 4@4½ per cent on prime double names. The market for electric and electric railway shares reflected the dullness of the general stock market. The traction stocks received a stiffer tone on the statements that Brooklyn Rapid Transit will show better earnings for the fiscal year then was expected. This stock fluctuated between 56 and 59 during the week, the sales being 88,526 shares. General Electric was quiet and steady, quotations keeping within 129 and 132¼. Only 720 shares were sold, but the stock at the close showed a net gain of 3 points. Metropolitan Street Railway held quite steady, closing at 156¼, a loss of ¾ of a point. Western Union Tel. was quiet, the prices varying between narrow limits, the highest and lowest being 79⅞ and 79½ respectively. The result of the week's trading was a net loss of ¼ point. The market for outside securities was generally firm and a little more active than during the week previous. Among the industrial Telephone, Telegraph & Cable stock, with the third assessment paid, closed at 6½ bid, with offerings at 7½. Illinois Transportation was active with fractional fluctuations. The following are the closing quotations of electric securities at New York, Boston and Philadelphia:

NEW YORK.

Gen. Elec.	132	Elec. Veh.	18
Bk. Rap. Tran.	57½	Elec. Veh., pfd.	40
Met. St. Ry.	156¼	Gen. Car	5½
Am. Tel. & C.	90	Ill. Elec. Veh. Tran.	1⅝
West. Un. Tel.	79¾	N. Y. Elec. Veh. Tran.	7½
Am. Dist. Tel.	25	New Eng. Elec. Tran.	4
Com. Cable	160	Tel., Tel. & C. of Am.	4½
Elec. Boat	15	Hud. Riv. Tel.	116
Elec. Boat, pfd.	30	N. Y. & N. J. Tel.	160

BOSTON.

New Eng. Tel.	123¼	Westingh. Elec. pfd.	64
Mex. Tel.	2	Gen. Elec. pfd.	138⅞
Westingh. Elec.	45	Am. Tel. & Teleg.	143½

PHILADELPHIA.

Elec. Stor. Bat.	70	Phil. Elec.	2⅜
Elec. Stor. Bat. pfd.	75	Pa. Elec. Veh.	3½
Elec. Co. of Am.	9	Pa. Elec. Veh., pfd.	2
Gen. Elec. Auto	¼		

BOSTON ELECTRIC LIGHT.—The annual report of the Boston Electric Light Company for year ended June 30 is issued as follows:

	1900.	1899.	1898.
Gross income	$990,797	$910,892	$809,943
Operating expenses	531,327	604,972	513,409
Profits	459,469	305,919	296,535
Interest charges	91,958	53,522	70,393
Net for stock	367,511	252,397	233,453
Dividends	184,724	143,908	102,000
Surplus	*182,787	108,489	131,453

*Increased to $436,082 by including $253,294 premium on stock sold.

President Gilbert says: "The annual statement shows in comparison with last year an increase of 10½ per cent in the gross business, and a decrease in the ratio of operating expenses from 63.8 per cent in 1899 to 50.6 per cent in 1900. During the first half of the past year the operating expenses were 52.7 per cent, during which time we were obliged to continue one of the old stations in the city proper, as well as operate the new station; in the latter half of the year the operating expenses were 48.6 per cent. The reduction in the percentage of cost for the production of the current was more than we anticipated, in consequence of which we felt no hesitation in returning during the year to the old rate of 2 per cent quarterly dividends instead of 1½ per cent. The company has three pieces of real estate which are no longer needed for the uses of the business, and which at a conservative valuation are worth $600,000 or $700,000." This real estate is to be sold.

ELECTRIC STORAGE BATTERY.—At a special meeting of the stockholders of the Electric Storage Battery Company the resolution recently adopted by the Board of Directors to amend the company's certificate of incorporation to enable the company to take advantage of the more liberal New Jersey laws was ratified. Regarding the business that is being done by the company, it was stated that up to July 1, 1900, the gross sales amounted to $1,400,000, against $600,000 the same time last year, an increase of $800,000. During the second half of the last fiscal year the business was greatly in excess of the first half, and it was said, with the present outlook, the same would be true this year. At the present rate it is expected the net earnings for this year will be about $1,000,000,

CHATTANOOGA RAPID TRANSIT.—The charter for the Consolidated North Side Street Railway Company, capitalized at $100,000, has been received from the Secretary of State. Several weeks ago the Rapid Transit Company, of Chattanooga, the majority stock of which is owned by J. P. King and associates of Philadelphia, Pa., bought the North Chattanooga and Signal Mountain lines, and the charter of the Consolidated North Side Railroad Company is the preliminary step to the absorption of the two North Side lines by the Rapid Transit. The final transfer will be made at the expiration of the legal time required to be given to stockholders of the change. The Rapid Transit line will then have 32 miles of track in continuous operation.

CINCINNATI STREET RAILWAY.—The recent recommendation of the directors of the Cincinnati Street Railway Company to increase the capitalization $2,000,000 was ratified by the stockholders at their annual meeting on July 25. The company is now capitalized at $18,000,000. The increase in the capital stock was made to defray expenses incurred through the placing of new batteries, etc. Of the increase authorized, $650,000 will be issued about Oct. 1. The stockholders are given the privilege to subscribe to the new stock pro rata, the basis being one share at par for every twenty-five shares held. The stock has been selling up to 129.

STREET RAILWAYS PURCHASED.—The Massachusetts Board of Railroad Commissioners has approved the terms of the proposed purchase of the Quincy & Boston Street Railway Company by the Brockton Street Railway Company. The purchaser is to assume all outstanding debts and obligations, and shall exchange its stock share for share to the amount of $767,400. The commission has also approved the purchase of the New Bedford, Middleborough & Brockton Street Railway Company by the Brockton Street Railway Company, the purchaser agreeing to exchange stock share for share to the amount of $350,000, and to assume all liabilities.

DIVIDENDS.—The Boston Elevated directors have declared a regular semi-annual dividend of 2¼ per cent per share, payable Aug. 15. The Board of Directors have declared the dividend of 1½ per cent on the common stock of the Twin City Rapid Transit Company. On Aug. 15, 1899, there was paid 1 per cent; on Feb. 15, 1900, 1½ per cent. The Denver Gas & Electric Company will pay a dividend of 1⅝ per cent on Aug. 20.

THE DIRECTORS OF THE PHILADELPHIA ELECTRIC COMPANY have made two calls on the stock, of $1.25 each, one payable Nov. 21 and the other payable Jan. 21. It is stated that the money thus raised will be used for new construction work. The various plants are now taxed to their full capacity and it will be necessary to provide increased facilities to meet the growing demand for electric light and power.

BOND ISSUE.—The stockholders of the Danville Railway & Electric Company, Danville, Va., have authorized a mortgage for $400,000 to be placed on the property of the company. The bonds are to run 40 years, and bear interest at 5 per cent. The property was conveyed to the Guardian Trust & Deposit Company, of Baltimore, as trustee.

LOWELL, MASS.—The Massachusetts Board of Gas and Electric Light Commissioners, has authorized the issue of 1000 shares of new stock (par $100) by the Lowell Electric Light Corporation, to be offered to the stockholders at par, in proportion to their present holdings.

CLINTON, MASS.—The Clinton & Hudson Street Railway Company has been authorized by the State Board of Railroad Commissioners to increase its capital stock from $100,000 to $160,000. The company asked for permission to issue $75,000.

THE GEORGIA ELECTRIC LIGHT COMPANY has given a first mortgage to the Unitel States Mortgage & Trust Company, New York, for $2,000,000, bearing 5 per cent interest.

THE ATLANTA RAPID TRANSIT COMPANY, Atlanta, Ga., has given a first mortgage for $1,000,000 to the United States Mortgage & Trust Company, New York. The interest rate is 5 per cent per annum.

Commercial Intelligence.

THE WEEK IN TRADE.—The conditions of trade throughout the country are thus summarized in Bradstreet's: "Trade conditions still favor the buyer; general fall demand, though fair in view of midsummer conditions, is still below expectations and below a year ago; bank clearings are at the lowest for two years past, and failures are slightly more numerous, though no marked tendencies are perceptible. On the other hand, gross railway earnings hold the percentages of

gain previously shown." The crop situation inspires confidence and hopefulness, being better on the whole. The outlook for corn is satisfactory, spring wheat is more promising both as to quality and quantity, and there is an unquestionable improvement in the cotton crop situation. In the iron and steel industries the volume of business in finished material was very large, being induced by the low prices. More business in iron and steel is reported from Pittsburg, Chicago and St. Louis. The section of country west of the Mississippi reports the best trade conditions, relatively speaking. Bradstreet's reports the number of failures for the week as 170, as against 183 last week and 156 the same week last year. The failures for the month of July numbered 817, with liabilities of $9,750,627, the assets being 44.5 per cent of this amount. In the metal market copper is quiet with a light demand. Prices are unchanged from last week's quotations. The semi-annual United States copper statistics show that the domestic production for the six months ended June 30 amounted to 134,577 long tons, the importations for the same period being 20,066 tons, making a total of 154,643 tons. The shipments aggregated 89,618 tons, leaving 65,025 tons for home consumption.

THE OTTAWA ELECTRIC COMPANY, the greater portion of whose plant was destroyed in the conflagration of April last, has completed arrangements for reconstruction on a larger scale than ever, and for the installation of a plant for light and power which will be up to date. In the new building there will be three sets of water wheels installed, and a place provided for a fourth set for future requirements. Each set will consist of three 39-in. "Victor" wheels mounted on one horizontal shaft. Each set will develop 1150 horse-power. These wheels have been contracted for with the Stilwell-Bierce & Smith-Vaile Company, Dayton, Ohio. The speed will be governed by "Lombard" governors. This station will be equipped with three, and, later, four, alternating-current generators, each of 966 horse-power, and two exciters driven by separate turbines, each capable of exciting the fields of all the generators in the station. There will be a direct-current generator of 500 horse-power especially constructed to supply, in conjunction with the company's storage battery plant, the 500-volt and 250-volt motors throughout the city. The arc lighting plant will consist of six arc generators with a capacity of 150 arc lights each, driven in pairs by induction motors of 250 horse-power each, direct coupled. This manner of driving will permit of the street lighting load being thrown on any generator or on any water-wheel unit, either in the main or in the auxiliary station, thus providing every possible guarantee for an uninterrupted service. The arc lamps to be used with the system are the direct-current, enclosed-arc, long-burning type. The main generators will be directly coupled to the water wheel shafts, no belting being used, thus securing great efficiency and good regulation. The contracts also include two more generators of 966 horse-power, to be used in the remodeling of the auxiliary station. The main station will contain the switchboard, which will necessarily be an elaborate affair. It will be entirely fire-proof, and so constructed that no interruption of service may take place from accidents at the switchboard.

EXPORTS OF ELECTRICAL MATERIAL.—The following were the exports of electrical material from the port of New York for the week ended Aug. 4: Argentine Republic—3 cases automobiles and parts, $200; 132 packages electrical material, $4,611; 21 cases motors, $2,742; 13 packages motor machinery, $1,061. Antwerp—79 packages electrical material, $4,026. British Australia—61 cases electrical material, $2,901; 38 packages electrical machinery, $3,500. Barcelona—6 packages electrical material, $140. Brussels—3 packages electrical material, $11. Brazil—29 packages electrical material, $1,426; 13 packages electrical machinery, $1,628. British East Indies—91 packages electrical material, $3,054. Bremen—2 cases electrical material, $160. British West Indies—4 cases electrical material, $79. Cuba—24 packages electrical material, $299. Central America—13 packages electrical material, $375. Ecuador—18 packages electrical material, $270. Glasgow—42 packages electrical machinery, $2,850; 3 packages electrical material, $250. Genoa—6 cases electrical material, $615. Hamburg—39 packages electrical material, $3,834. Havre—6 packages electrical machinery, $202; 84 packages electrical material, $12,639; 2 cases motors, $50. Lyons—14 cases motors and parts, $2,750. Liverpool—97 packages electrical machinery, $1,250; 11 packages electrical machinery, $541; 6 packages motors, $450; 138 trolley poles, $4,897. London—58 cases electrical machinery, $2,923; 51 cases electrical material, $5,485. Marseilles—85 packages motor trucks, $4,750. Manchester—29 packages electrical material, $1,734. Mexico—22 cases electrical material, $193; 97 packages electrical machinery, $12,975. Nova Scotia—25 packages electrical material, $238. Naples—49 packages electrical material, $11,296. Newcastle—7 packages motor machinery, $875. Peru—6 cases electrical material, $154. Southampton—9 cases electrical machinery, $389; 4 packages electrical material, $207. U. S. Colombia—26 packages electrical material, $904. Venezuela—106 packages electrical material, $901.

STANLEY-NORTHERN COMBINATION.—A combination has been effected between the Stanley Electric Manufacturing Company and the Northern Electrical Manufacturing Company, termed a mutual manufacturing and selling arrangement, whereby each company will handle the apparatus of both companies. The Stanley Company has already started large forces of men at work erecting new and commodious shops at Pittsfield, and the Northern Company has already nearly completed an extensive addition to its plant at Madison, Wis., intended to admit of an increase of 50 per cent in the output. This will be ready for occupancy within thirty days. It is the intention to add to their present apparatus whatever may be necessary to enable them to furnish full and complete lines of both kinds of apparatus, including the largest sizes of direct-current machinery suitable for large power transmission plants and street railway work. This new combination ought to secure for itself a large increase over the patronage previously bestowed upon the separate companies. Each company is possessed of ample financial resources to enable it to carry out its undertakings expeditiously. They have both been conservatively and successfully managed from small beginnings until they have become potent factors in the trade, and no doubt their future under the new arrangement will be a continuation of strong, vigorous growth.

STURTEVANT APPARATUS ABROAD.—The rapid growth of the export business of the B. F. Sturtevant Company, of Boston, Mass., manufacturer of blowers, heating and drying apparatus, engines, forges, electrical equipment, etc., is well exemplified by recent foreign orders for forges which aggregate 200 for Japan, 75 for Russia, 40 for Germany, 32 for Canada and 24 for Sweden, in addition to large numbers distributed through its London and Continental stores. Domestic demands have also increased in the same line during the past few months, large forge equipments having been furnished to several shipbuilding and locomotive shops in the United States. Manual training, trades and technical schools have also been placing some large orders with this company.

ELECTRICAL EXPORTS.—The subjoined from the Boston News Bureau is rather misleading: "The General Electric and Westinghouse companies have a practical monopoly of American electrical machinery abroad. Exports of electrical machinery for 1900 amounted to $4,328,917, compared with $2,736,110 last year." Both these concerns have extensive alliances and affiliations abroad, and hence are far from having a "practical monopoly," if only on that account. At least half a dozen other American electrical companies could be named as very large exporters of apparatus, while there are many concerns whose shipments in the aggregate amount to a very tidy sum of money each year. And their number tends to increase markedly as they reach out for foreign trade.

EXPORT TELEPHONE APPARATUS.—The Austro-Hungarian Consulate General, New York City, has received from the Royal Hungarian Ministry of Commerce, Buda Pest, Hungary, a number of programmes and specifications prepared in French and Hungarian, in regard to the proposed installation and equipment of new central telephone exchanges at Buda Pest for local service and long-distance work. Copies of these documents can be secured on application and on payment of $2 for each version. It would be interesting, though neither novel nor strange, to see these new exchanges equipped with American apparatus, after the manner of many other European exchanges.

THE UNION SWITCH & SIGNAL COMPANY, a corporation belonging to the Westinghouse interests of Pittsburg, Pa., has just awarded an important contract for electrical apparatus to the Westinghouse Electric & Manufacturing Company. The Union Switch Company is erecting a new factory, and the machinery in the shops is to be operated electrically. The polyphase system is to be used, and the installation will consist of Westinghouse generators, transformers and 45 motors. These motors will be distributed throughout the works to operate the tools and machinery.

PHILADELPHIA CITY HALL.—The members of the Board of Commissioners of Philadelphia visited New York recently to investigate elevators for the tower of the City Hall, and have reported a contract with the Sprague Elevator Company. The rise is no less than 402 ft. The elevator car will be a large one, capable of carrying at least 20 or 30 people.

HAGERSTOWN, MD.—Bonds have recently been sold by the city of Hagerstown, Md., for the erection and equipment of a municipal light and power plant. The Westinghouse Electric and Manufacturing Company have secured the contracts for two of their 175-kw, two-phase engine type generators and standard switchboard. The dynamos will be driven by 300-hp Buckeye engines.

THE WHEELER CONDENSER & ENGINEERING COMPANY, New York, has received a contract for a complete condenser plant for the power house of the Portuguese Tramway Company, Lisbon, Portugal.

THE STOREY MOTOR COMPANY, it is reported, is in the market for machine tools for its new works in Harrison, N. J. It is moving its plant from Trenton to Harrison.

Special Correspondence.

ENGLISH NOTES.

LONDON OFFICE ELECTRICAL WORLD AND ENGINEER,
July 23, 1900.

THE WATERLOO AND BAKER STREET UNDERGROUND RAILWAY.—Good progress is being made in the tunnel work of the Waterloo and Baker Street Underground Electric Railway, which, when completed, will provide a much-needed means of communication between Waterloo, the West End and the northwestern part of London. The present method of communication between these parts of the city consists mainly of 'buses. It is proposed to build an entrance to the subway at Trafalgar Square, and work is now being carried on to determine the best location for the same. The line will pass directly under Regent Street, approaching the vicinity of Piccadilly Circus. That section of the tunnel from the river to Trafalgar Square is completed and a shaft has been sunk in the middle of the river for the purpose of carrying the tunnel under the Thames. Compressed air is being used in the river work.

THE LONDON UNITED TRAMWAYS.—For four years, this company has been contending with the authorities for the right of overhead construction on its entire system. Mr. J. Clifton Robinson, the managing director and engineer of the company, has been conducting the work of securing the desired concessions and a bill granting the same has already been passed by the House of Commons. The company has, in addition to securing the right to use the overhead construction, obtained the right for all of the extensions for which it applied. The first section of the system is now being completed. The system will comprise about forty miles of road and will take in practically the entire western suburbs of London. The system is entirely suburban, yet it will no doubt prove to be an excellent object lesson to Londoners, and through it they may come to realize the advantages that they might enjoy by having tramways enter the heart of the city.

TRAMWAYS IN LONDON.—The London County Council has recently endeavored to obtain powers to extend the tramway to the Piccadilly Circus, by way of Shaftsbury Avenue, but for some reason the concession was not granted by the vestry. There seems to be opposition on the part of the vestries to extension of any of the roads towards the heart of the city. Recently the Clerkenswell vestry interposed a strong opposition against the extension of the tramway in Farringdon Road to the city boundary at Farringdon Road station. The objection seems to have been based upon the fact that the tramways would interfere with some costers, who have taken possession of a portion of the public street. If this is the true reason, it would seem that public convenience is set aside in favor of a sentimental consideration of itinerent dealers. The vestry has therefore assumed the position of obstructors to progress. It is thought that a complete reorganization of the rights of the vestries will, of necessity, be made before long. There are twenty-seven different vestries in the city, each of which has supreme control over the streets in its district, and while the managers of the tramways are progressive and anxious to give Londoners better service, their enterprise is always antagonized by the vestry authorities. There is a constant state of warfare between the tramway companies and the various vestries over very trivial matters, such as the paving of streets, the exact distance between rail and curb, etc., which is rather annoying, to say the least, to those entertaining progressive ideas. The London County Council has been for several months making efforts to extend its tramways in and about the city, but for the above reasons, their efforts are set at naught.

General News.

THE TELEPHONE.

ATHENS, TENN.—The Athens Telephone Company is preparing to enlarge and renovate its plant in this place.

GALION, O.—The Central Union Telephone Company has obtained from the City Council a 25-year extension to its franchise.

SALEM, OHIO.—The capital of the Columbiana County Telephone Company has been increased from $200,000 to $300,000.

GRAND RAPIDS, MICH.—The Citizens' Telephone Company, of this city, has increased its capital stock from $500,000 to $550,000.

DETROIT, MICH.—The Michigan Telephone Company's long-distance telephone service in the upper peninsula has been completed.

ST. LOUIS, MO.—The Kinloch Telephone Company is now ready to begin the construction of the telephone line from St. Louis to St. Charles.

HOLLADAY, VA.—The Louisa Telephone Company has completed its line from Mineral, in Louisa County, to Tinder's station, Orange County.

WILLIAMSTON, N. C.—The Williamston Telephone Company has been organized here; capital, $900. W. C. Manning and others are the corporators.

LOWELL, MASS.—The Erie Telephone system made a net gain of 2121 subscribers in July. Total number connected July 31, 123,576. Number waiting connection, 4405.

SANDUSKY, O.—The Sandusky Telephone Company has obtained a temporary injunction restraining the Central Union Telephone Company from using the former's poles.

WARREN, O.—The Warren & Niles Telephone Company is preparing to locate a 100-drop exchange at Vienna Center, to take care of the farmers' community system in that vicinity.

YOUNGSTOWN, O.—Mr. W. W. Johnson, manager of the Central Union Telephone Company's exchange here, has been promoted to be general manager of the company's exchange at Columbus.

SAN FRANCISCO, CAL.—The Pacific States Telephone Company made a net gain of 812 subscribers in July. The total number connected is 77,302, which includes 19,332 in San Francisco.

LOGANSPORT, IND.—The committee representing the City Council of this city has reported against giving the Central Telephone Company an open franchise. The Council will adopt the report.

OTISCO, N. Y.—The Otisco and Cedarville Telephone Company of Otisco, has been incorpated. Capital, $1,500. Directors: H. D. Pomeroy and I. W. Bardwell, Otisco; Lee Cummings, Navarino.

GREENSBORO, S. C.—The Greensboro Telephone Exchange has been chartered, with a capital stock of $50,000. The incorporators are T. J. McAdoo, V. C. McAdoo, C. M. McAdoo and R. M. King.

ALBANY, N. Y.—The Fillmore Telephone Company of Fillmore, Allegany County, has been incorporated. Capital, $5,000. Directors: Charles Ricker, William S. Mills and John H. Howden, Fillmore.

CHARLESTON, S. C.—The Sea Island Telephone Company has been organized, with headquarters at Charleston. The capital stock is $10,000. The company will connect the sea islands and Charleston by telephone.

CENTRALIA, MO.—The Centralia Telephone Company has been incorporated. Capital, $6,000. Incorporators: Addie Chance, J. A. Chance, A. B. Chance, Sallie Chance, Frances Chance, all of Centralia; H. S. Booth, attorney, Centralia.

CLEVELAND, OHIO.—The Columbiana County Telephone Company has filed a mortgage in favor of the Euclid Avenue Savings & Trust Company, trustee, to secure the payment of an authorized issue of $300,000 first mortgage gold bonds.

OTTAWA, O.—The system of the Ottawa Telephone Company was badly damaged by an electrical storm recently. Two hundred telephone instruments were ruined and one-third of the drops in the exchange were burned out. Telephone and telegraph wires also suffered.

VINTON IOWA.—The Bento County Telephone Company, Vinton, has been incorporated. Capital, $25,000. Incorporators: P. G. Henderson, J. H. Davis, of Marion; H. J. Nietert, of Cedar Rapids, and Frank G. Ray, S. S. Lichty, G. M. Gilchrist, A. S. Chadbourne, all of Vinton.

LOCKPORT, N. Y.—The Home Telephone Company, of Lockport, has been incorporated. Capital, $125,000. Directors: M. B. Butler, Niagara Falls; George H. Frost, Buffalo; A. E. Lord, S. R. Rawson, I. H. Griswold, James A. Drake, F. H. Sudro, and F. W. Martin, Elyria, Ohio.

ARCHBOLD, O.—The Independent Construction Company has recently built a telephone line between Versailles and Antwerp, O., and is now building an exchange at Covington, O., with a toll line running from Covington to Versailles, connecting with the Union City toll line at the latter place.

COLUMBUS, O.—State Auditor Gilbert has notified the county auditors throughout the State to place a valuation of $10 each on telephone instruments belonging to the American Bell Company; also that back taxes for five years shall be collected at the same uniform rate. This is according to a recent decision of the State Attorney General.

DETROIT, MICH.—The National Telephone Equipment Company has filed articles of incorporation, with a capital of $100,000, to manufacture switchboard generators and telephone equipments. The president is E. H. Parker, formerly an officer and director of the Detroit Switchboard Construction Company, and prominent in the independent telephone movement.

WILLMAR, MINN.—The Northern Electric Telephone Company of this city has bought the Interstate Telephone Company's exchanges at Appleton, Ortonville, Graceville, Wheaton and Clinton, Minn., and at Big Stone City, S. D., as well as the toll lines connecting these towns. These purchases make the Northern one of the strongest independent telephone companies in the Northwest.

RICHMOND, VA.—The Long Distance Telephone Company, of Virginia, has completed its organization. The officers are: President, J. R. Kemper; vice-president, C. W. Scott; secretary and treasurer, W. H. Laughlin. The directors are: Lieutenant Governor Echols, J. F. Clemmer, Andrew Bowling, Dr. F. M. Hanger, J. S. Cochran, Captain J. H. Grabill, C. W. Scott, F. W. Simms and N. C. Watts.

SAN FRANCISCO, CAL.—The Pacific States Telephone & Telegraph Company, John I. Sabin president, is preparing to open offices in Portland, Ore. It is a combination of the principal long distance and other telephone companies of the Pacific Coast. The movement amounts practically to a removal of the principal offices of the Sunset Telegraph & Telephone Company from San Francisco to Portland. The action of the San Francisco authorities as to enforcing license fees, etc., against the telephone companies in San Francisco is held responsible for this move.

PATERSON, N. J.—The Paterson, Passaic, and Suburban Telephone Company of Paterson, has arranged to have its charter so amended as to enable the company to extend its business throughout New Jersey, and into adjoining States. The company is one of the largest independent companies in New Jersey. The directors were elected at its annual meeting: Joseph Bamford, Walter Bamford, George Post, Wayne Dumont, George A. Myers, John K. Burke, Bernard Katz, William L. Williams, Alfred Post, Joseph Bamford, Jr., J. W. Lindsay and Herbert Katz.

LONG ISLAND CONDUITS.—The New York and New Jersey Telephone Company is laying wooden conduits for an underground system in Long Island City. The conduits are built of creosoted timber. There are four timbers, each 5 ins. square, bored out to the diameter of 3 ins. They are laid on creosoted lumber and the joints are filled with pitch. Each conduit will hold a cable containing at least 100 telephone wires. It is understood that the underground system is to be generally introduced in Long Island City.

ROCHESTER, N. Y.—The local Bell Telephone Company has adopted a new course in dealing with striking linemen. Thomas Fitzgerald and James Snider were last week placed under arrest on court orders issued by Judge Sutherland.

William Skinner, who claims that he was assaulted by the two men, pulled from his bicycle and badly hurt, is plaintiff in an action for $1,000 damages against them, and the order of arrest was granted on Skinner's complaint. The men were released on $300 bail. It is said that civil actions will be brought against all the strikers who assault employees of the company. A number of arrests on warrants have been made, but the criminal proceedings did not amount to much and rioting has been kept up. The Bell Company has offered a reward of $500 for the arrest of anybody caught tampering with their wires or apparatus.

BELL TELEPHONE OUTPUT.—The American Telephone instrument statement for the month ended July 20 shows:

	1900.	1899.	1898.	1897.
Gross output.....	65,463	48,873	21,551	15,859
Returned	30,093	18,028	10,011	7,241
Net output.....	35,370	30,845	11,540	8,618
Since Dec. 20:				
Gross output.....	411,609	389,899	187,884	127,778
Returned	162,753	109,765	83,306	51,847
Net output.....	248,856	280,134	104,578	75,931
Total outstanding.....1,829,361		1,405,384	1,023,699	849,780

SEATTLE, WASH.—The operators in the exchange of the Sunset Telephone Company recently struck for increased salaries, but the company refused to compromise, and attempted to place inexperienced girls in the exchange. The resulting service was so poor that the Seattle Chamber of Commerce and business men protested and demanded that the old girls be re-instated. The company offered to take back all but the leader of the strike, but the operators stood out, and the business men made another demand upon the company for the employment of all the operators. The company refused to do this, with the result that 100 telephones in business houses were ordered taken out in a single afternoon. It is stated that between 2000 and 3000 will be discontinued unless the company comes to terms. A rival concern has applied for a franchise, which will probably be granted. The Western Central Labor Union has taken steps to support the action of the striking telephone girls.

ELECTRIC LIGHT AND POWER.

PRATTVILLE, ALA.—There is talk of establishing an electric light plant in this place.

BIRMINGHAM, ALA.—There is some talk of building an electric light plant in this place.

BELLAIRE, OHIO.—The Bellaire Gas and Electric Company has decided to build and equip a new electric plant.

MAZOMANIE, WIS.—The electric light plant in this place was destroyed by fire recently, entailing a loss of about $15,000.

WYOMING, IOWA.—A special election will be held here to vote on the question of issuing bonds for a municipal electric light plant.

BRADFORD, O.—This village will issue bonds to the amount of $20,000 for a municipal lighting plant and for additional fire protection.

KINSTON, N. C.—The Kinston Electric Light Company has just completed installing a 140-hp engine and an incandescent dynamo carrying 1800 lights.

PORT GIBSON, MISS.—It is stated that the General Electric Company has obtained the contract for the new apparatus in the municipal plant in this city.

ALTOONA, PA.—The Altoona Electrical Engineering & Supply Company has the contract for erecting a new municipal electric light plant at Conemaugh, Pa.

STILLWATER, MINN.—The plant of the Stillwater Gas & Electric Company will be enlarged. Further particulars may be obtained from Superintendent N. Johnson.

BIRMINGHAM, ALA.—The Irondale Water, Light and Power Company has been incorporated by F. W. Turpin, N. H. Sewall and Robert Zell; capitalization, $100,000.

AUBURN, ME.—It is stated that a new plant and power house will be erected by the Lewiston & Auburn Electric Light & Power Company on the Little Androscoggin River.

BEAVER FALLS, PA.—The council of College Hill borough has instructed its light committee to advertise for bids for the erection of an arc and incandescent electric-light plant.

DEENKIRK, IND.—The City Light and Power Company of Deenkirk, has been incorporated; capital, $8,000. Incorporators—J. H. Brown, K. A. Tracy and M. J. Cook, all of Deenkirk.

DOTHAN, ALA.—Bids will be received in the course of a few days for the erection of a new municipal electric light plant in this place to cost about $10,000. The mayor can give further information.

INDIANAPOLIS, IND.—Ground has been broken here for the erection of an immense power plant at Washington and New Jersey Streets. The purpose is to furnish room and electric power to manufacturers.

HAGERSTOWN, MD.—George A. Williams Company, electrical contractors, has been awarded the contract for the construction of a new electric-light plant for Hagerstown, Md. The bid was $52,590.20.

COLUMBUS, OHIO.—The Citizens' Electric Light and Power Company, of Kenton, has been incorporated; capital, $20,000. Incorporators—John Glenn, W. A. Ross, Theodore Miller, Jacob Ferbing and W. L. Sinly.

ATHENS, O.—The Athens State Hospital, Mr. John M. Hayman, president, has decided to install a lighting plant, and has asked for bids for a direct-connected steam engine and generator. Bids will close Aug. 16.

ST. LOUIS, MO.—The Missouri Edison Electric Company made an announcement Aug. 1 that the price to consumers of the standard 16-cp electric lamps would be reduced from 25 cents to 20 cents each after that date.

ALBANY, N. Y.—The New York and Queens Electric Light and Power Company has been incorporated; capital $2,500,000. Directors—Henry R. Wilson, New York City; Thomas W. Stephens and H. L. Snyder, Montclair, N. J.

BROCKVILLE, ONT.—The ratepayers of this place have voted to raise $100,000 for the purchase of the plant of the Brockville Light & Power Company. The plant will be taken over next October and will be managed by the commissioners.

WELLSVILLE, O.—Mr. Charles McNutt has been made receiver for the Citizens' Electric Light & Power Company. The debts of the company are $23,420.62 in excess of the assets. An assessment is to be made on the stockholders.

ALBANY, N. Y.—The Cattaraugus Electric Light and Power Company, of New Albion, Cattaraugus County has been incorporated, capital, $12,000. Directors—A. J. Setter, Collins Centre, and Frank Crawford and H. P. Bishop, of Cattaraugus.

ALBANY, N. Y.—The Genesee Electric Company of Rochester, has been incorporated to supply electricity for light, heat, and power in Rochester; capital, $50,000. Directors—P. H. Flynn, Fred C. Cochen, Brooklyn; William A. Boland, New York City.

HENDERSON, S. C.—The plant of the Henderson Electric Company will be sold at public auction Sept. 1, together with the franchise of the company. The property goes to the highest bidder, and is sold under two deeds of trust in the hands of A. C. Zollicoffer.

ELIZABETH, N. J.—Lightning struck the power house of the Suburban Electric Light Company, of Union County, recently, ruining an alternating dynamo. The fire alarm wire was burned out, as were many telephone wires in different parts of the city.

HARRISBURG, PA.—The Citizens' Light, Heat and Power Company, of New Castle has been incorporated; capital $10,000. Incorporators: S. Paisley, R. H. Whaley, J. A. Stevenson, A. D. Mornes, C. H. Hilborn, C. H. Akens, B. F. Butler, all of New Castle.

SAN FRANCISCO, CAL.—The decoration and illumination committee of the California Admission Day Celebration has planned to illuminate the City Hall dome and Ferry Depot on the night of Sept. 9. The estimated cost of the illumination and wiring is $10,500.

BOULDER, WEST AUSTRALIA.—This place, which is in the new gold fields, was recently equipped by the B. F. Sturtevant Company, of Boston, Mass., with generating sets for lighting and power purposes, and electric motors for operating hoists, etc., in the mines.

OIL CITY, PA.—The Oil City electric light plant was sold a few days ago to the Citizens' Light and Power Company, of this city, a newly-organized company, officered as follows: President, D. J. Geary; secretary and manager, Stanley Loomis; treasurer, George S. Oberly.

SAN FRANCISCO, CAL.—The Truckee River General Electric Company is installing electrical machinery and other apparatus at its sub-station in Virginia City, Nev., whence current will be distributed to the 27 mining companies interested in the reopening of the Comstock mines.

TOLEDO, OHIO.—Bids will be received until Aug. 27 by the Board of Trustees of the Toledo State Hospital for furnishing three direct-connected engines and dynamos, and switchboard. Communications on the subject should be addressed to H. A. Tobey, Superintendent Toledo State Hospital, Toledo, Ohio.

COLUMBUS, O.—A prominent citizen of this city has brought mandamus proceedings against Director Kauffman, of the city water works department, to compel him to place the municipal lighting plant in operation. The plant was closed down recently because it proved too expensive, and because of a lack of funds.

SAN FRANCISCO, CAL.—A new electric power station is to be erected at the United States Navy Yard, Mare Island, Cal. Almost the entire capacity of the present power house is required to operate electric motors. The additional electric plant will be located near the new dry dock, which is now in course of construction.

BRACEBRIDGE, ONT.—A by-law has been passed to raise $27,000 by debentures for the purpose of extending the present power, putting in new water wheels and dynamos, etc. Four contracts will be let, one covering excavating and rock work, another the dam and power house, the third steel flume and water wheels, and the fourth electric plant.

SAN FRANCISCO, CAL.—The Independent Electric Light & Power Company, San Francisco, recently made successful tests of the generators in its new main power station. The San Francisco & San Mateo Electric Railroad was operated, 500-volt current being supplied through the Westinghouse rotary transformers installed in the Eighth Street sub-station.

PHILADELPHIA, PA.—The Electric Company of America has secured a temporary injunction restraining the officers of the Edison Illuminating Company of Altoona, Pa., from issuing 650 proposed new shares of stock. The Electric Company of America holds a majority of the present shares, but it is claimed the new issue might leave the company in the minority.

COLLINWOOD, O.—The Chase Construction Company, of Detroit, which has a contract to install a municipal lighting plant, has been granted permission to substitute generators furnished by the Fort Wayne Electric Works, in place of those built by the Warren Electric Manufacturing Company, of Sandusky, O., as originally specified. The Detroit Company claimed the latter concern could not furnish the goods in time.

HAMILTON, O.—The City Council of Hamilton has practically decided to install a system of underground conduits for electric wires, which are to be rented to the companies requiring them. City Engineer Dillon has made an investigation of the plan, and advises the installation of separate conduits for both high and low tension wires, about seven ducts of each kind being advised. He estimated that the ducts would cost about $2 per lineal foot, including double manholes.

NEWPORT NEWS, VA.—The Consumers' Light, Heat & Ice Company has awarded the contract for the building of its power house and the entire power installation and pole lines to G. A. Williams & Company, of Jersey City, N. J. The electrical apparatus will consist of one 175-kw and one 125-kw type Westinghouse two-phase generators, voltage 2200; two Westinghouse exciters, five-panel switchboard, Westinghouse standard, equipped with plunger switches. The 175-kw generator will be a duplicate of the generators furnished recently to the municipal electric plant at Hagerstown, Md. The contract also calls for a large number of Manhattan series arc lamps. Work will be begun immediately upon the construction of the power house.

THE ELECTRIC RAILWAY.

ANDERSON, IND.—The Union Traction Company of this city has discharged 23 employees who refused to be vaccinated, according to recent order.

WARREN, O.—The Mahoning Valley Electric Railway Company has been granted a franchise for its proposed line from Warren to Tibbitts Corners.

FORT WORTH, TEX.—The Glenwood and Polytechnic College Street Railway Company of this city has purchased the Arlington Heights Street Railway.

GREENSBURG, PA.—The Westmoreland Street Railway Company has decided to extend the line from Manor to Irwin, paralleling the Pennsylvania Railroad.

KOKOMO, IND.—A franchise has been granted to the Central Traction Company, of Indianapolis, to operate an electric railway between this city and Indianapolis.

LONDON, OHIO.—The Madison County Commissioners have granted a franchise through the county to the Urbana, Mechanicsburg & Columbus Electric Railway Company.

MINNEAPOLIS, MINN.—The Twin-City Rapid Transit Company's gross earnings during June were $239,404, an increase of $37,438, and net, $129,669, an increase of $22,222.

FLORENCE, COL.—The Florence electric street railway has been incorporated. Capital stock, $500,000. The incorporators are H. A. Cook, James Reed and Harry Robinson.

KOKOMO, IND.—A franchise has been granted to Gilbert Wilkes and W. H. Wolfenden, of Detroit, Mich., and T. C. McReynolds, of this city, for an electric railway from Kokomo to Greentown.

CANAL DOVER, OHIO.—Canal Dover promoters, headed by Mr. W. A. Garver, have been successful in securing the right of way for a new electric railway between this place and Massillon.

WARREN, O.—The Trumbull County Commissioners have granted a 50-year franchise to the Youngstown & Sharon Electric Railway Company. The road will extend from Youngstown to Sharon, via Hubbard.

PINE BLUFF, ARK.—W. H. Keiser, of Chicago, was granted by the City Council a franchise to build and operate an electric railway in the city. He will also be given a contract for city lighting for 15 years.

NEW HAVEN, CONN.—The Moodas & East Hampton Electric Railway Company and the Mutual Construction Company have been incorporated. The line will be extended along the bank of the Connecticut River.

MASSILLON, O.—The Canton & Massillon Street Railway Company has commenced the work of reconstructing its road. The line is to be equipped with heavy rails of standard gauge and with new double-truck cars.

CAMDEN, N. J.—The American Universal Underground Electric Railway Company has been incorporated, with headquarters here. Capital, $200,000. Incorporators: W. Bartram, J. M. Deal, W. C. Alexander, C. P. Ballinger.

NEWARK, N. J.—The North Jersey Street Railway Company sent a check for $77,390.14 to the City Controller of Newark, being the amount of 5 per cent on the gross earnings of the company during the year ending April 30.

STEUBENVILLE, O.—Local parties are negotiating for the franchises granted some time ago to George Maxwell by the City Councils of Steubenville and Toronto for the construction of an electric railway between the towns mentioned.

NORWALK, O.—The promoters of the Sandusky, Bellevue, Monroeville Electric Railway, which is now under way, announce that they will extend their line from Norwalk to North Fairfield, Greenwich, New London and Chicago Junction.

SPRINGFIELD, OHIO.—The Springfield Street Railway Company has received a unique car, which will be used exclusively for trolley parties. Above the trucks it resembles a small lake steamer and the marine idea is carried out throughout.

TRENTON, N. J.—The Philadelphia and Jersey City Traction Company, which, for about three years has been fighting its way from Philadelphia to this city, and from this city to Jersey City, has obtained the right to cross the Delaware River.

DANBURY, CONN.—The Citizens' Steamboat Line, the Peekskill Traction Company and the Danbury & Bethel Street Railway Company are interested in a scheme to build a trolley from Peekskill, through Danbury, to Long Island Sound at Bridgeport or Norwalk.

BOSTON, MASS.—The New York, New Haven & Hartford Railroad Company has commenced the erection at Brayton Station in Somerset, of a storage battery house, in connection with the use of electric motive power on the Fall River, Warren & Providence Railroad.

NILES, OHIO.—Elmer E. Wilson and others, who recently bought out the plant of the Niles Electric Company, have secured the right of way for an electric line from Niles to Salt Springs, also from Salt Springs to Youngstown. A large hotel is to be built at Salt Springs.

CHATTANOOGA, TENN.—The Secretary of State has granted a charter to the Northside Consolidated Street Railroad Company, of Chattanooga, with $100,000 capital stock. The incorporators are S. W. Divine, W. B. Royster, E. D. Lilley, Charles T. Divine and J. B. Sizer.

SANDUSKY, O.—The Sandusky, Bellevue, Monroeville & Norwalk Electric Railway Company has decided to utilize a new indestructible roadbed within the limits of the cities named. The Indestructible Roadbed Company, of New York City, has been given the contract for the work.

SPRINGFIELD, MASS.—The Springfield Street Railway Company will petition the State Railroad Commissioners for authority to increase its capital stock $700,000. The present capital is $1,500,000. The increase will be used to pay indebtedness and to construct new lines.

NEWARK, N. J.—The North Jersey Street Railway Company is about to build another trolley line from the Oranges to Newark. The new line is to be in continuation of the South End road, in Montclair, which runs from Montclair along Orange road to its terminus at the East Orange line.

AMSTERDAM, N. Y.—The Amsterdam Street Railway has been sold to the Fonda, Johnstown & Gloversville Railway Company, the price being about $175,000. It is expected that the line will be extended across the country, connecting with Johnstown and Gloversville.

SPRINGFIELD, ILL.—The Mattoon and Evansville railroad has been incorporated with a capital of $50,000. The incorporators and first board of directors are as follows: John C. Welling, J. T. Harahan, William G. Bruen, Thomas E. King, Clarence W. Moore, all of Chicago.

WILMINGTON, N. C.—At the annual meeting of the Wilmington, N. C., Street Railway Company, the following board of directors, all of New York, was elected: T. A. McIntyre, C. A. Leib, O. T. Crosby, B. F. O'Connor, J. H. Barnhardt, J. W. Martenis and H. A. Whiting.

BELLEVUE, OHIO.—The Toledo, Fremont & Norwalk Electric Railway Company has succeeded in securing a franchise from the City Council. All of the necessary franchises and rights of way have now been obtained except in Monroeville. The road has been completed from Toledo to Clyde.

AUSTIN, TEX.—Robert M. Messick, of Pittsburg, Pa., the representative of a large eastern syndicate, is in this city, negotiating for the purchase of the two electric street railway systems here. He has also made a proposition to Mayor John D. McCall for the purchase of the municipal electric light plant.

NEW YORK, N. Y.—On July 24, the Metropolitan Street Railway Company began running through cars from Fourth Street to Fort George, at the upper end of Manhattan. The route is by the way of Sixth Avenue and Amsterdam Avenue to Fort George, using the tracks of the Third Avenue Company above 126th Street.

HOUGHTON, MICH.—Track construction has been started in Hancock, Mich., on the Houghton County Street Railway. Nearly all the rights of way have been secured; land for the power station in Hancock has been purchased, and machinery ordered. Considerable work has been done on the grading of the road.

LYONS, N. Y.—The necessary rights of way between Lyons and Sodus Point for an electric road have been secured by James D. Bashford and Calvin Hotchkiss, of this place. The road will connect with Rochester and the Sodus Bay electric line running from Rochester to Sodus Point. New York capitalists will finance the work.

AKRON, OHIO.—The new Akron power house of the Northern Ohio Traction Company was badly damaged by fire on July 29. The loss will probably exceed $35,000. The Akron city lines and the Akron, Bedford & Cleveland Road were effectually tied up for several hours, and power was finally secured from the Cuyahoga Falls power house.

PLAINFIELD, N. J.—Senator John Kean's electric railway running between Elizabethport and Elmora has been sold to the Riker-Hine syndicate, which operates the Plainfield Street Railway, the Westfield & Elizabethport Street Railway and the Rahway Street Railway. The Riker-Hine syndicate now controls nearly 60 miles of tracks in Union and Middlesex counties.

KOKOMO, IND.—Horace Stilwell, chief promoter of the Central Traction Company, says the right of way between this city and Indianapolis has been obtained—all secured by direct purchase, except 20 miles. The company has petitioned the council at Kokomo to modify the franchise secured at its hands. If this is done, nothing remains in the way of speedy construction of the line.

MANSFIELD, O.—The Mansfield Street Railway Company is making some extensive improvements to its power house, in preparation for the new line to Shelby. Contracts have been placed for a Bates-Corliss engine, a Babcock & Wilcox 475-hp boiler and a large stack. The Sturtevant system of induced draught will be used in the boiler room. New car barns are also contemplated.

DAYTON, OHIO.—A meeting of the stockholders of the Dayton & Xenia Traction Company will be held Aug. 15, when it is proposed to increase the capital stock of the company to $1,000,000. Wilmington business people are urging the company to extend its Bellbook division to their town and offers of right of way and other inducements have been made. It seems probable that the offers will be accepted.

NEW YORK, N. Y.—It is stated that the New York, Westchester & Connecticut Traction Company has completed plans for an extensive system of trolley lines in the eastern section of Westchester County and a part of Connecticut. The new company will be a rival of the "Huckleberry" system. The company has filed a mortgage of $2,500,000 in Westchester County in favor of the Hamilton Trust Company of Brooklyn.

CLEVELAND, O.—The public works, water works and fire department officials have asked the City Council to embody a provision for the double-trolley system or some other practical protection against electrolysis, in the franchise which that body is preparing to introduce at the instance of the Cleveland City Railway Company. The officials claim that the leakage of electricity is causing great damage to the water, gas and other pipes.

COLUMBUS, O.—The Urbana, Mechanicsburg & Columbus Electric Railway, of which Gen. H. A. Axline is president, has made application to the City Council for a franchise. The company offers to sell eight tickets for 25 cents, or thirty-three tickets for $1.00, good within the city limits, provided the city makes no demands for a share in the receipts. Otherwise the company agrees to pay 2 per cent of the gross receipts for a 25-year franchise.

INDIANAPOLIS, IND.—The board of public works has been informed that the many exactions in the franchise admitting interurban lines to Indianapolis has occasioned the Union Traction Company to declare it would land its passengers at the city limits. The principal objection is to the provision requiring universal transfers. Merchants and the people generally are asking that the interurban lines be not interfered with but given equally liberal privileges.

MICHIGAN CITY, IND.—The Northern Traction Company, of La Porte, has accepted the terms of the franchise, giving it power to build an electric car line in Michigan City, and now makes the announcement that the line will be built within the specified time. It is believed, however, that the Northern Traction

Company will transfer its franchise rights to the Michigan City & La Porte Railroad Company, which has a capitalization of $300,000.

MILWAUKEE, WIS.—It is reported that the Chicago & Milwaukee Electric Railway Company has purchased a railway franchise recently granted to Messrs. Haynes and Clausen of Kenosha, Wis. It is stated that this will be the beginning of a fight between the Chicago & Milwaukee Company and the Milwaukee Company, which is also seeking a franchise for the construction of a line in Kenosha, Wis., unless the two companies come to an agreement between themselves.

COLORADO SPRINGS, COL.—The Colorado Springs Rapid Transit Company has been building a number of new cars. They are 29½ ft. in length, with vestibules enclosed. The open portion of the car will seat 16 people, two in a seat. Mr. Lawton states that improvements which his company is now making with standing room occupied. The car is provided with push buttons at each seat. Mr. Lawton states that improvements which his company are now making will cost about $26,000.

CHICAGO, ILL.—The first annual meeting of the stockholders of the Union Traction Company was held here July 24. In his report President Roach said the labor war and the opening of the Northwestern Elevated have cut into the earnings of the surface lines. The following directors were elected: Jesse Spalding, John M. Roach, Walter H. Wilson, Charles L. Hutchinson, C. K. G. Billings, William Dickinson, R. A. C. Smith, H. B. Hollins, James H. Eckels, P. A. B. Widener, and John V. Clarke.

DETROIT, MICH.—The Michigan and Ohio Electric Railway Company has been incorporated with a capital stock of $200,000. It proposes to build and operate a third rail electric railway between Detroit and Toledo. Franchises and private rights on the way are all secured. Ashwell & Co., of Detroit, are the engineers laying out the road. Among the incorporators are: Judge Donovan, W. W. Johnson and Milton Carmichael, of Detroit; and Washington I. Robinson, representing New York capital.

CLEVELAND, OHIO.—Judge A. W. Lamson and Hon. V. C. Taylor, acting for the Portage Lakes Traction Company, have succeeded in securing a franchise from the county commissioners for an electric line between Kent and Ravenna, Ohio. This portion of the road will be built at once. An effort is being made to secure a franchise from Cleveland to both towns with spur lines to Brady's Lake, Twin Lake and Hudson. The Ravenna-Kent line will be operated by power furnished by the Kent Water & Power Company. A franchise will be granted in Kent next week, for which the company agrees to sell eight tickets for 25 cents. James Corrigan and Frank Rockefeller, wealthy Clevelanders, are furnishing capital for the project.

RAVENNA, OHIO.—The promoters of the newly-organized Portage Lake Transit Company have secured the consent of property owners for the construction of their line, and they will apply to the county commissioners for a franchise in the near future. The route will be from Bedford to Hudson and Brady's Lake, by the way of a private right of way, touching Twin Lake and Pippin Lake, with a Y to Ravenna and Kent. The road will probably go into Cleveland over the Northern Ohio Traction Company's line, and it will open up a beautiful territory to Cleveland people. It is claimed that Frank Rockefeller, of Cleveland, is furnishing the capital for the road.

ST. LOUIS, MO.—Five cars of the Transit Company were damaged during the night of July 27 by dynamite placed on the tracks. Nobody was injured. The first two explosions occurred near Spring and Easton Avenues; the third on the southern electric line on Arsenal, between Ninth and Thirteenth Streets. The latter explosion was terrific. The floor of the car was blown out and the seats twisted out of place. Windows in nearby houses were broken. A fourth explosion occurred in front of 3617 Easton Avenue. At 2:10 a. m. the fifth occurred. It wrecked the front part of an owl car at Peck and Kossuth Avenues. There were scarcely any passengers on any of the cars, and damage in all cases was practically confined to the cars.

TOLEDO, O.—Incorporation papers have been applied for at Columbus and Lansing, Mich., for the Michigan & Ohio Electric Railway Company. The capital stock is temporarily $200,000, and the incorporators are Judge J. W. Donovan, W. L. Johnson, Milton Carmichael, W. W. Johnson and Washington L. Robinson. The latter is trustee, representing the interests of New York capitalists who are backing the enterprise. The headquarters of the company will be in Detroit. The Murphy third-rail system will be utilized, and contracts have been entered into with the General Electric Company for the electric equipment. W. H. Ashwell & Company, a Detroit engineering firm, are preparing specifications and will be in charge of construction work.

THE AUSTIN DAM & SUBURBAN RAILWAY, an electric line of Austin, Tex., has not been in operation since the destruction of the great dam across the Colorado River at that place on April 7. The road obtained its power from the municipal power plant, which was run with water from the lake made by the dam. The City Council is considering the matter of forfeiting the franchise of the company on the ground that it is not complying with the terms of its charter in failing to operate its line. The road is now in the hands of a receiver. The street railway system of the Austin Rapid Transit Company, which also derived its electric power from the municipal plant, has been only partly operated since the destruction of the dam, horses being used in place of electricity for the movement of the cars. The latter company proposes to build its own power plant.

SOERABAYA, JAVA.—There is no electric railway yet in operation in this city, but a steam tramway is being run by the Oost Java Stoomtram My. The only electric-light installation is a small one at the Simpang Club. Some years ago a firm in this city got a concession from the government to light the city, but they were unable to finance it. Since then, however, the Javasche Electriciteit My, of Soerabaya, have asked for a new concession, and there is every reason to believe that it will be granted. In that case, they will be in the market for supplies on a larger scale than heretofore, as their needs have been confined hitherto to what is required for electric-light installations in a few sugar plantations. Until now they have bought only French electrical goods. Manufacturers of suitable apparatus would do well to send catalogues direct to the Javasche Electriciteits My, or to the Holland Herring & Commission Company, New York City.

THE AUTOMOBILE.

THE AKRON AUTOMOBILE POLICE PATROL COMPANY has been incorporated with a capital stock of $200,000. The new company will build electric patrol wagons, hose wagons, delivery wagons, drays, etc., and will have control of the patents owned by Electrical Engineer Loomis, of the Akron fire department, who recently completed an electric patrol wagon for the police department of that city.

AUTOMOBILE RACE.—What is said to be the first automobile race meet ever held on a race track in this country, began at the Branford Park track in New Haven, Conn., on July 25. Twenty vehicles took part in the tournament. The Automobile Club of America, the Locomobile Club of Bridgeport, and clubs in Boston and Hartford were represented, as were also makers of automobiles in all parts of the country and in Europe.

NEW INDUSTRIAL COMPANIES.

THE DETROIT MOTOR WORKS have been incorporated at Detroit, Mich., with a capital stock of $10,000.

SPRINGFIELD, ILL.—The Halliday Elevtor Company, of Cairo, has increased its capital from $30,000 to $80,000.

THE AUTOMATIC ELECTRIC FIRE-ALARM COMPANY has been incorporated in St. Louis, Mo., with capital stock of $100,000, by John W. Baker, H. F. Koch, C. T. Johnson and others.

THE IDEAL ELECTRIC CONTRACTING COMPANY of New York City has been incorporated. Capital, $1,000. Directors: Henry Nekritz, William E. McKeen and Adolf Hirschfeld, New York City.

THE SCIENTIFIC MANUFACTURING COMPANY, of Chicago, has been incorporated to manufacture electrical and scientific instruments. Capital, $50,000. Incorporators: H. L. Peters, E. F. Farrell and C. R. Harris, all of Chicago.

THE GRANITE STATE ELECTRICAL WORKS has been organized in Lisbon, N. H. Capital, $25,000. Incorporators H. C. Libbey, H. H. Atwood, C. J. Currier, J. W. Richardson, W. Williams, all of Lisbon; H. C. Libbey, attorney, Lisbon.

SACO, ME.—The Reuterdahl Electric Company has been organized at Saco for the purpose of making and dealing in dynamos, storage batteries and generators, with $100,000 capital stock. The officers are: President, Arvid Reuterdahl of Providence, R. I.; treasurer, George F. Weston of Providence, R. I.

LEGAL.

THE ELECTRIC STORAGE BATTERY COMPANY and the Electric Boat Company have filed papers in suits for infringements of patents in the United States Circuit Court, Southern District of New York, against the Gould Storage Battery Company, and in the United States Circuit Court, Northern District of Ohio, against Sipe & Sigler, manufacturers of Willard storage batteries.

THE BROOKLYN 10-CENT FARE CASE.—The Appellate Division of the Supreme Court in Brooklyn has decided in a test case submitted to it that the Brooklyn Rapid Transit Company has a legal right to charge a 10-cent fare to Coney Island. The case was that of Arthur Barnett, who obtained a judgment for $65 against the company for being ejected from a car, after having refused to pay an extra 5 cents.

OBITUARY.

MR. J. B. SAUNDERS, who has been in the service of the C & C Electric Company for over 12 years as cashier, died suddenly last week. He went away on a two weeks' vacation, but returned ill and was taken to St. Luke's Hospital, when it was found that he was suffering from brain fever. He passed away suddenly at 2 a. m. Thursday. Mr. Saunders was widely known in New York electrical circles. He occupied a position of trust and responsibility with the company, was a thoroughly conscientious and indefatigable worker, and enjoyed the goodwill and esteem of all his associates.

PERSONAL.

MR. C. M. WILKINS, of Partrick, Carter & Wilkins, Philadelphia, Pa., has just returned from a month's vacation, which was spent in the mountains of Colorado.

MR. JOHN T. McROY, the well-known manufacturer of conduits, has just returned home from his European trip, full of anecdote, reminiscence and observation.

MR. W. C. L. EGLIN, chief of the electrical engineering department of the Philadelphia Electric Company, has just returned after a six weeks' visit abroad to the Paris Exposition.

MR. WILLIAM J. LATTA, until recently general agent of the Pennsylvania Railroad, and now so largely interested in electrical enterprises, has established a $5000 scholarship in the University of Pennsylvania in memory of his great-grandfather, who was one of the six members of the class first graduated from the university, then known as the College and Academy of Philadelphia.

MR. CHAS. A. SCHIEREN, the well-known belt manufacturer, is in favor as the next Republican candidate for the mayoralty of Greater New York. His record as Mayor of Brooklyn leads to the belief that he would poll a very heavy vote, irrespective of politics. Mr. Schieren's portrait in oil is to hang in the Municipal Assembly rooms with those of other Mayors of the old separate cities.

MR. OSCAR T. CROSBY, who has been abroad for many months, has made a flying trip to this country and will return to Paris for his family, then settling down again at Washington. He had a most interesting experience along the Blue Nile, penetrating through Abyssinia, a part of Africa never before traversed by a white man. He also sailed the Red Sea, stayed at Aden and visited Khartoum.

Trade Notes.

THE PUMPELLY STORAGE BATTERY AND ELECTRIC MOTOR COMPANY, Chicago, has changed its name to the National Vehicle Battery Company.

THE C. W. HUNT COMPANY, New York, is distributing a little 16-page pamphlet, giving information and illustrations of industrial railways, electric locomotives, steam and electric hoisting machines, elevators, cable railways, etc.

CROSS ARMS.—The Western Electric Company is carrying in stock a very complete line of 2 and 4-pin cross arms for electric-light trade. These arms are made of selected lumber, hand-painted, and are full 3¼ x 4¼, the regulation size.

THE ELECTRIC APPLIANCE COMPANY, of Chicago, claims that its new line of telephones actually reproduce the natural tone of the voice. It has just gotten out handsomely-printed descriptive matter giving illustrations and details.

MR. W. S. REYNOLDS, of Detroit, Mich., who has carried on an extensive jobbing business in Michigan, representing as sales agent several well-known manufacturers of electrical specialties, will in the future devote his time exclusively to the interests of the Shelby Electric Company, Shelby, Ohio.

THE WARREN ELECTRIC & SPECIALTY COMPANY, of Warren, O., the well-known manufacturers of incandescent lamps, has been noted for its "anti-trust" policy and has lately resumed its campaign of vigorous attack. This opposition, now dating back four years or more, is unchanged, and attention is called to the fact that its announcements exhibit a steady maintenance of an uncompromising attitude.

COMBINATION FITTINGS.—The J. H. White Manufacturing Company, 127 North Tenth Street, Brooklyn, New York, has issued a pamphlet of its gas-electric combination fittings. It contains 80 pages, each page being illustrated with cuts of different fixtures and fittings, the line including a great variety of pieces. The company also produces stamped and spun shells, screws and ornaments, brass castings, etc.

HELMET OIL.—Messrs. Charles H. Besly & Company, 10 North Canal Street, Chicago, report that they are receiving many orders for Helmet oil from the Western States. They have just received orders for two complete shop quipments to go to India, including lathes, drills, screw-plates, Gardner die-stocks, Helmet oils, etc. They are having a big demand for general machinists' supplies, in addition to the receipt of orders for their own specialties. This house carries a very complete stock of fine tools and machinists' hardware.

FULLER APPARATUS.—The Fuller Company, engineers, Detroit, Mich., has issued a 16-page pamphlet showing illustrations of its apparatus. This pamphlet is a departure from the usual style of trade literature in that it gives illustrations without descriptive text. The name of each piece of apparatus is given under the cut illustrating it. The illustrations are very clearly executed half-tones. This company manufactures air propellers, engine-generators, enclosed automatic and other types of engines, motor starting boxes, ventilating fans of every style, switchboards, etc.

THE AUTOMATIC OILING COMPANY has taken a suite of offices in the Morton Building, 116 Nassau Street, New York. The company has been recently organized to place upon the market and install the pneumatic oiling devices formerly manufactured by the Wilson-Whitney-Davis Oiling Company. The new organization owns all the patents covering the apparatus and has facilities for doing the very best work. All designing and installing is under the personal supervision of Mr. Edward E. Pollock, the manager of the company. Mr. Henry W. LeRoy is the president.

THE NATIONAL TELEPHONE EQUIPMENT COMPANY, Detroit, Mich., has purchased the entire property, patents, machinery, etc., of the Detroit Switchboard & Telephone Construction Company. The National Company is now in a position to contract for the construction and equipment of telephone plants. Its switchboards and instruments are in successful operation throughout the country and are giving satisfaction. Its plant is equipped with modern machinery, and it will carry a complete line of supplies. The company's headquarters are at 330 Lafayette Avenue, Detroit. Mr. W. F. Richardson is secretary.

THE MERCHANTS' ASSOCIATION, of New York, is mailing 5,000 copies of a circular of particular interest to all merchants in the State of Texas. This supplements the circular previously sent out, making a general announcement of the concessions which had been granted by the Southern Pacific Company in favor of New York. This second circular gives the details of the concessions. The association intends maintaining an aggressive campaign for the purpose of bringing Texas trade to this city to as great an extent as possible. This circular will be followed in a few days by another one setting forth the desirability of the New York market more in detail.

THE PRATT & WHITNEY COMPANY.—A special meeting of the stockholders of the Pratt & Whitney Company, Hartford, Conn., was held on July 25, for the purpose of authorizing the directors to sell and convey the company's plant and business to the Pratt & Whitney Company, which is to be organized under the New Jersey laws, and to wind up the affairs of the Pratt & Whitney Company of Hartford. In view of the fact that all the proxies had not been received, the meeting was adjourned until Aug. 16, when it is expected that the requisite number of shares will be represented to vote upon the questions for which the meeting was called. The New Jersey Company will be organized for $2,750,000, of which $1,225,000 is to be preferred stock, and $1,555,000 common stock.

ONONDAGA DYNAMOS AND MOTORS.—Besides the building of large units for electric lighting and power purposes, the Onondaga Dynamo Company, Syracuse, N. Y., is placing on the market small direct-current motors from one-half to six horse-power. These motors are of the enclosed type, dust proof, and adapted for service in any position—on the floor, side wall or ceiling. These motors are designed for high or slow speed; they are efficient, compact and neat in appearance. A number of these motors have recently been shipped to Berlin, Germany, and a permanent agency has been established there. Shipments have also been made to Buenos Ayres, South America. The past year has been the most prosperous in the history of the company. It has more than doubled its capacity, and the outlook for the future is bright.

HIGH PRESSURE INSULATORS.—Mr. Fred M. Locke, Victor, N. Y., has, during the past year, increased his manufacturing facilties three-fold, and yet they are taxed to the utmost to keep up with the rapidly increasing business. Mr. Locke reports that he is shipping to California three carloads per week of the 10½-in. "Victor" type brown porcelain insulators. These insulators are subjected to a salt-water test of 120,000 volts at the factory. The Bay Counties Power Company of California is using Locke "Victor" insulators on its transmission lines, which aggregate over 265 miles in length. The Standard Electric Company of California is also using "Victor" insulators on its lines, which are over 150 miles in length. A new 1900 edition of Mr. Locke's catalogue, No. 5, is now in press, and is about ready for distribution.

ELLIOTT INSTRUMENTS.—In connection with tramway plants, a demand is arising for recording instruments to indicate the actual current or output of the station at various times through the 24 hours, and to meet this demand Messrs. Elliott Brothers, London, England, are making their recording ammeters work from separate shunts to practically any range of current which may be desired. In an instrument recently constructed, which is designed for the Dublin United Tramways Company to record current from zero up to 6,000 amperes, the shunt for this instrument is placed as part of the main positive bus bar on the load panel. All the actual recording instruments are made of the same type, the different ranges being obtained by the different sections of the shunts which are proportioned to deal with the current which has to go through them, Messrs. Elliott Brothers having constructed recording ammeters to read down to currents as low as from 0 to 250 milliamperes.

THE ELECTROLYSISPROOF CONDUIT MANUFACTURING COMPANY, 605 Manhattan Building, Chicago, is calling attention to its asphalt paper conduit, which is claimed to be electrolysis proof. This conduit is an excellent insulator and protects lead-sheathed cable from vagrant electric currents. It has been subjected to all kinds and manner of severe tests by electrical engineers, as well as service tests in large cities, and it is said to meet the essential requirements in a conduit of this kind. The ducts come in lengths of 7 ft., weighing 2 lbs. to the foot. The inside diameter is 3 ins., but they may be made in any desired size, from 2 ins. to 10 ins. These conduits have been in service underground for 12 years, and, it is said, show no deterioration of any character. They are impervious to moisture, and, being non-metallic, will not rust; nor are they affected by the gas which saturates the soil of city streets. This conduit possesses many important features which it would be well for all those interested in such matters to carefully look into. The company also makes an insulating lining for distributing boxes, manholes, iron poles, etc. Mr. W. F. McCarthy is the manager of the company.

Record of Electrical Patents.

UNITED STATES PATENTS ISSUED JULY 30, 1900.

[Conducted by William A. Rosenbaum, Patent Attorney, Times Bldg., N. Y.]

654,144. ELECTRIC SIGNAL REGISTERING SYSTEM; O. P. and R. H. Yurgae, Milwaukee, Wis. App. filed May 14, 1900.

654,583. MACHINE FOR WINDING AND INSULATING ELECTRIC COILS; J. C. Anderson, Jersey City, N. J. App. filed Feb. 7, 1900. This machine is adapted to wind electromagnets, induction coils, etc., of bare wire, the convolutions of which are insulated along the layers by an interwound silk thread, and between the layers by a wrapping of paper. The copper and silk are wound side by side and fed along until a layer is completed; then, without stopping the rotation, a sheet of paper is wrapped around the finished layer and a new layer of copper and silk commenced over the paper. The machine cuts off the paper a different length each time, and the entire work of injecting the paper and reversing the layers is done automatically.

654,586. CONDUIT ELECTRIC RAILWAY SYSTEM; F. M. Ashley, New York, N. Y. App. filed Feb. 26, 1898. The sectional working conductor is attached to the removable cover of the conduit.

654,595. METHOD OF OPERATING DYNAMO ELECTRIC MACHINES; E. J. Berg, Schenectady, N. Y. App. filed May 26, 1900. This is a method of adjusting the angular position of the rotating member of a synchronous dynamo electric machine, which consists in causing said member to slip until the desired angular position is secured.

654,630. RADIOPHANY; H. V. Hayes and E. R. Cram, Cambridge, Mass. App. filed July 7, 1897. (See page 214.)

654,631. HIGH OR LOW WATER ALARM FOR BOILERS; E. D. Hays, Philadelphia, Pa. App. filed Dec. 15, 1899. The terminals of an alarm circuit are arranged in connection with a water column, to give an alarm at various elevations of the water.

654,656. ELEVATOR CONTROLLER; N. O. Lindstrom and A. Cowperthwait, New York, N. Y. App. filed April 11, 1900. The invention consists of fluid pressure motors respectively controlling electric switches and the brake, which switches serve to stop, start, reverse and change the speed of the actuating motor, the fluid pressure motors being controlled by electromagnetic valves, operated by suitable circuit closers in the car.

654,658. ELECTRIC RAILWAY; G. A. Lyncker, Munich, Germany. App.

filed April 23, 1900. The circuit closing mechanism in a sectional conductor system is operated by current supplied from a battery on the car.

654,663. ELECTRIC REGULATING DEVICE; W. S. Moody, Schenectady, N. Y. App. filed May 21, 1900. The regulating device consists of a single primary winding and a number of sub-divided secondary windings in inductive relation thereto, the latter being connected in series with the respective mains wherein it is desired to effect the regulation.

654,679. ELECTRIC ARC LAMP; C. Schuster, Pittsburg, Pa. App. filed June 13, 1899. Details of that class of lamp in which the regulating is accomplished by the heating of an expansive strip.

654,700. ELECTRIC CONTROLLER; W. Asbury, New York, N. Y. App. filed Dec. 1, 1899. This is a device arranged so that only one combination (the next highest) can be made at one movement, but will permit a return of the operating device to the starting position by a single movement from any point.

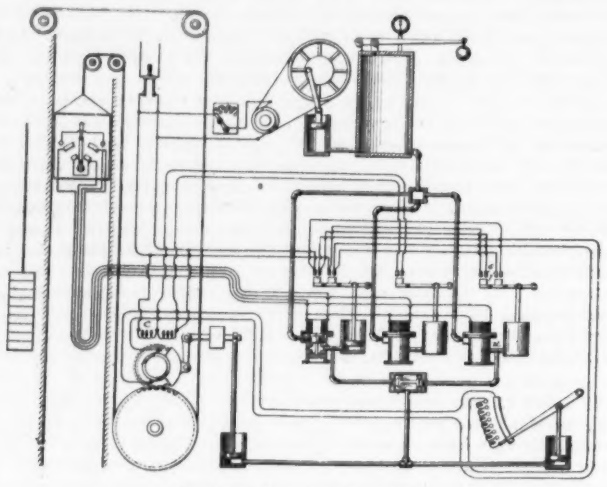
654,703. MEANS FOR CONNECTING CABLES; N. Basset, Philadelphia, Pa. App. filed Dec. 30, 1899. For separating the conductors in a junction box as they emanate from the cable, a partition is inserted, provided with a number of slits into each of which one or more of the conductors are disposed.

654,734. ELECTRIC COMMUTATOR CLEANER; A. H. Jahn, Homestead, Pa. App. filed Nov. 23, 1899. The core of a solenoid is connected through suitable levers with a cleaning block. The block is forced into contact with the commutator when the circuit through the solenoid is closed.

654,747. SUPERVISORY SIGNALS FOR TELEPHONE SWITCHBOARDS; F. R. McBerty, Downers Grove, Ill. App. filed Nov. 13, 1897. This invention is a general or pilot signal for use in telephone switchboards in association with supervisory signals referring to united lines.

654,749. SIGNAL APPLIANCE FOR TELEPHONE SWITCHBOARDS; James L. McQuarrie, Chicago, Ill. App. filed Nov. 22, 1897. This invention concerns the calling apparatus for an operator in a telephone switchboard, and means for permitting her to supervise established connections.

654,750. SWITCHBOARD FOR TELEPHONE LINES; F. R. McBerty, Evanston, Ill. App. filed Dec. 26, 1899. This invention concerns apparatus for supervising and switching telephone lines equipped for the automatic control of signals and for the supply of current for exciting the sub-station transmitters from a central source in the switchboard.



654,656.—Elevator Controller.

654,752. SPEED GOVERNOR ATTACHMENT FOR ELECTRICAL APPARATUS; J. H. McGurty, Jersey City, N. J. App. filed April 25, 1900. To regulate the speed of a controller shaft the shaft is connected with an air cylinder, whose piston is constructed to have an intermittent, free and retarded movement.

654,758. APPARATUS FOR TELEPHONE SWITCHBOARDS; Joseph J. O'Connell, Chicago, Ill. App. filed May 12, 1899. Switching mechanism associated with the seat wherein the connecting plug normally rests, for automatically including a source of signaling current in circuit with one of the contacts of the plug when the latter is lifted from its seat preparatory to making a connection, and for removing said source of signaling current from circuit when the called subscriber answers the signal by removing his telephone from its hook.

654,803. TROLLEY WHEEL; S. G. Reynolds, Eastern, Pa. App. filed Dec. 11, 1899. The centre of the wheel is hollow, to receive a felt packing, the chamber being closed by removable side disks.

654,816. ELECTRICAL TRANSMISSION OF POWER; I. E. Storey, Trenton, N. J. App. filed Nov. 18, 1899. In a system comprising a variable speed generator and storage battery, the field of the generator carries an opposing coil, and means are provided whereby the voltage generated by the dynamo in excess of that required to charge the battery and carry the load, will cause current to flow through the opposing field coil.

654,821. FLASHLIGHT SYSTEM; Martin Wright, San Antonio, Tex. App. filed April 26, 1900. Details.

654,834. SECRET TELEGRAPH SOUNDER; G. H. Landgraf, Waterloo, Wis. App. filed June 21, 1898. This is a sounder of miniature proportions, which can be suspended from the ear or teeth, to produce telegraphic signals audible only to the operator.

654,847. AUTOMATIC CIRCUIT BREAKER; W. M. Scott, Philadelphia, Pa. App. filed Nov. 1, 1897. This is an electromagnetic device adapted to open two or more circuits simultaneously or in any required order of succession.

654,848. AUTOMATIC MAGNETIC CIRCUIT BREAKER; W. M. Scott, Philadelphia, Pa. App. filed Jan. 5, 1898. The special feature consists in shunting the main switch of the circuit breaker by a supplemental circuit breaker adapted to protect the contacts of the main switch at the instant of their separation.

654,851. SEMAPHORE OPERATING MECHANISM; J. Shoecraft, Eskridge, Kan. App. filed Oct. 10, 1899. Details.

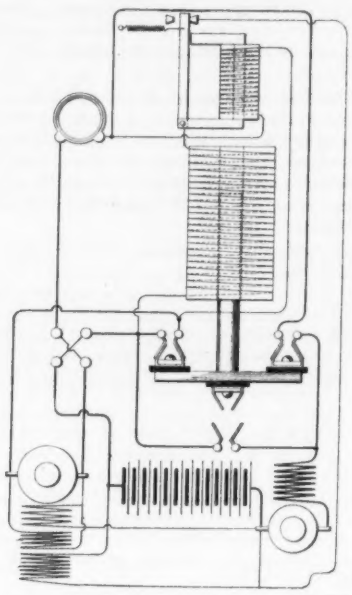
654,871. ELECTRIC CABLE; J. Y. Buchanan, Edinburg, Scotland. App. filed May 18, 1900. An electric cable, comprising a conductor having alternate coatings of gutta-percha and a compound of india rubber and ozocerite, the innermost and outermost of such coatings being of gutta-percha.

741,573. SWITCHBOARD FOR TELEPHONE LINES; Charles E. Scribner, Chicago, Ill. App. filed Dec. 26, 1899. This invention concerns the operation of telephone lines in connection with a central source of current, and aims to avoid, as far as possible, sudden variations of current in lines in the process of switching them consequent on the accidental formation of circuits in the switchboard, such as produce troublesome noises in the telephone.

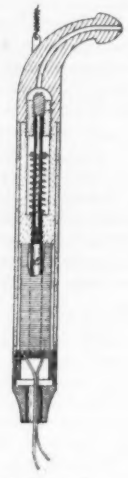
654,967. ELECTRIC SIGNAL AND FIRE ALARM; David Geywits, Rome, and William Still, Utica, N. Y. App. filed Feb. 16, 1900. Details.

654,983. CABLE HANGER; J. C. Hyde, Westhaven, Conn. App. filed June 11, 1900. A form of wire clip adapted to embrace the cable and hang from a suitable support.

654,999. ELECTRIC MOTORS; W. S. Moody, Schenectady, N. Y. App. filed May 7, 1898. This is a fan motor embodying various novel features of construction, tending to simplify and improve the general appearance.



654,816.—Electrical Transmission of Power.



654,834.—Secret Telegraph Sounder.

655,006. ELECTRIC LOCK; T. P. Pratt, Boston, Mass. App. filed April 21, 1900. The rotation of the knob is permitted or prevented by an electromagnet.

655,032. RECTIFYING ALTERNATING CURRENTS; E. Thomson, Swampscott, Mass. App. filed March 26, 1900. Means of maintaining synchronism between two electric machines connected in the same alternating circuit. comprising a synchronous motor and a source of supply therefor, delivering impulses of higher frequency but constant relation to the currents in said circuit.

708,582. QUICK-BREAK ELECTRIC SWITCH; W. F. Bossert, Utica, N. Y. App. filed March 10, 1899. The primary object of the invention is to guard against the movement of an auxiliary blade until its operating spring has acquired the maximum tension, so as to insure a quick-snap action thereof the instant the switchblade reaches a predetermined point in its movement.

655,063. ELECTRIC ARC LAMP; J. E. Davidson, Butte, Mont. App. filed Oct. 17, 1899. A lazy-tongs is inserted between the upper carbon and the actuating device.

738,026. GAS BATTERY; Andrew Plecher, Savannah, Ga. App. filed Nov. 23, 1899. A gas battery, comprising a cell formed of a porous, solid, non-conducting body, homogeneously filled with a chemically deposited metal of the platinum group, and having on one side a superficial electrode adapted to be covered by one gas, and on the other side a superficial electrode adapted to be covered by the other gas.

655,057. THERMOSTAT AND ALARM CIRCUIT CONTROLLED THEREBY; H. G. Carleton, New York. App. filed Sept. 8, 1899. (See Current News and Notes.)

655,113. ELECTROMAGNETIC TELEPHONE; Andrew Plecher, Savannah, Ga. App. filed Feb. 16, 1900. A resistance-varying medium for a telephone, consisting of a coil of fine bare wire of magnetic metal, having separated turns or convolutions interposed in the circuit and arranged to collapse and reduce resistance from magnetic action.

658,390. CONNECTION-COUNTER FOR TELEPHONE LINES; Charles E. Scribner, Chicago, Ill. App. filed Nov. 13, 1897. The transmission of a call and the operation of the line-annunciator thereby, followed by the establishment of connection with the line in response to the call, causes the act of registration.